Field Assessment Techniques for Bank Erosion Modeling

First Interim Report

Prepared for

US Army European Research Office USARDSG-U. **EDISON HOUSE** 223 Old Marylebone Road London, NW1 5TH England

Ву

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correctly in the field. An arreconnaissance for this purpos broader Sedimentation issues all aspects of Sedimentation a stability models to be applied channel stability problems as	seessment sheet is see. Because bank and sediment impressessment. The is and also could a precursor to	mechanisms and causes of river bank erosion has been developed as an aid to field at erosion problems are closely linked to eacts, the sheets encompass information on data collected are sufficient for bank d form the basis for qualitative analysis of the design of a stable geometry.		
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1. SCIENTIFIC WORK DONE

1.1 Logistics

The project has involved a concentrated and extended effort by the principal investigator, Colin Thorne, working personally on this project over a four month period.

In August the PI met the engineer in charge of the relevant work unit at the Waterways Experiment Station (Bradley Comes) at the San Diego meeting of the American Society of Civil Engineers. The PI presented a paper on bank stability response to channel grade control (Biedenharn et al., 1990) and Mr Comes presented a paper based on the first version of the Bank Erosion Assessment Guidelines (Thorne and Abt, 1989; Comes, 1990). They discussed the formulation and rationale behind the sheets and the comments and criticisms obtained from Professor Joseph Hagerty under a separate work order. Plans were made and dates set for field testing and evaluation of the sheets and guidelines after their revision in the light of the comments to date. It was planned to undertake fieldwork in early October.

However, in late August Mr Comes resigned his position in the Hydraulics Laboratory and moved to a new post in the Information Technology Laboratory. His supervisor, Dr Tony Thomas, took over direct control of the Bank Erosion Work Unit.

During September the Principal Investigator worked at the University of Nottingham to completely revise the Bank Erosion Assessment Sheets and their Guidelines on the basis of comments and criticisms of the earlier version, and experience of their use by the Principal Investigator and other scientists and engineers at WES during June 1990.

In early October further discussions took place by telephone and FAX between the PI and Dr Thomas regarding the scope, applicability and type information recorded on the sheets. With his wider perspective of river mechanics and stable channel design, Dr Thomas wished to see the sheets further modified and broadened to include more quantitative data and to cover all aspects of river sedimentation and sediment impacts, rather than concentrating solely on the banks. This approach is more demanding of the sheets and guidelines, but it has the potential to make them much more valuable as a tool in collecting and assembling the data required for semiquantitative and quantitative engineering-geomorphic analyses of rivers. The PI agreed whole heartedly with the thinking behind Dr Thomas's proposed development of the sheets. Lynil and/or





Special

By mid-October the sheets had been broadened to include greater consideration of the sedimentary processes and forms of the whole channel, and allow for the recording of quantitative measurements of channel size, geometry and sediment characteristics. The revised sheets may be found in Appendix A. To differentiate them from the earlier version and reflect their broadened scope, they have been renamed 'Sedimentation Analysis Sheets'.

The guidelines for use of the sheets had also to be heavily revised and broadened and this too was complete by mid-October. Revised guidelines may be found in Appendix B.

In a previous study, discussion had taken place between the PI and Mr Comes regarding the equipment needed to facilitate the collection of quantitative data during field reconnaissance trips. A field satchel or backpack was envisaged, containing everything needed by an engineer or geomorphologist charged with conducting a reconnaissance trip to a stream or river. Prior to his resignation Mr Comes acted on this idea by ordering the equipment required. Dr Thomas and Mr Robert McCarley at WES reconsidered the type of field equipment needed to make the field measurements involved in the new approach and found that this was well covered by the equipment already purchased and assembled at WES. A list of the equipment included in a standard field backpack may be found in Appendix B.

On October 15 the PI traveled to Vicksburg to meet with Dr Thomas, undertake field evaluation of the revised sheets, guidelines and field equipment, and plan the remainder of the project.

With Mr Comes's resignation, it was possible at this time to undertake the fieldwork around the country planned in the original proposal. Instead, by agreement with Dr Thomas, this major fieldtrip was postponed until the Spring of 1991, by which time a new leader for the Bank Erosion Work Unit will have been appointed. However, in order to keep the project moving forward, the opportunity was taken to test the sheets and guidelines locally by incorporating their use into a short course being run at WES at the time. This course, 'Sedimentation Investigations of Rivers and Reservoirs' included a field reconnaissance trip to a local water course and involved 18 engineers from several US Army Corps of Engineers Districts. These individuals had a wide range of background and degrees past experience in sedimentation engineering and field work. Hence, the group represented just the types of people required to test the sheets and guidelines as set out in the original proposal.

A one hour introductory lecture on sediment impact assessment was given by the PI on the morning of October 18 and the field reconnaissance trip was undertaken that afternoon to Clear Creek, Bovina, Mississippi. The results of the trip were discussed in the field that evening. A wrap-up session was held on the morning of October 19, to synthesize the main findings and allow feed back from the short course participants to the PI and Dr Thomas.

The results, comments, criticisms and recommendations are presented and discussed in the next 4 sections.

1.2 Bank Erosion Assessment Sheet Evaluation

The preliminary assessment sheets developed by Thorne and Abt (1989) were evaluated in the light of critical comment from project reviewers at the University of Louisville and post-project in at from engineers and scientists at the US Army Engineer Waterways Experiment Station. The changes made are detailed below.

The Title of the sheets has been changed to 'Sedimentation Analysis Sheets', to reflect their increased scope. The heading box use a defined reach in place of a location to delineate the study area. Parts 1 and 2 are essentially unchanged from the original version.

Part 3 has been heavily re-worked. It was realized that elements of observation were mixed with elements of interpretation in the old sheets. Also, the person completing the sheets was predicting future trends in river development while at the same time noting the present status. This led to some confusion. In the new version, the engineer is asked to record what he or she observes without at this stage making a prediction about the future. Questions concerning controls in the bed of the channel have been moved from this part to part 5 of the sheet (Channel Description). A section has been added on overbank deposits, and quantitative data on any levees present is now requested.

Part 4 has been similarly re-worked. It is more observational and excludes prediction about future trends. Questions about lateral channel controls have been moved to Part 5 and quantitative data defining the planform is now requested.

Part 5 now contains all questions pertaining to the form and controls of the channel. Measured dimensions are requested both for the flow on the day of observation and the channel full condition. The flow regime is defined and information on bed and bank controls recorded.

Part 6 is an entirely new part dealing in detail with the description of the bed sediments. The bed material is described by its type in the Wentworth Scale. The presence of an armor layer and the depth of loose sediment are noted and quantitative data on the size distributions of surface and substrate sediments are requested. The presence and types of sedimentary features such as bars and islands is dealt with,

again with quantitative data on surface and substrate sediment size distributions for bar sediments.

Parts 7 to 11 now deal with the left bank. The Parts are equivalent to Parts 6 to 10 in the old sheets. In the text below, the old part number appears in brackets behind its new equivalent. In part 7 (6), a section has been added to note the status of the bank in relation to bank protection structures. Also, measured values for bank height and angle replace the ranges requested in the old sheets. Similarly, actual layer thicknesses in feet replace the terms "thick" and "thin" in the old sheets. Finally, tension cracks are known to be very damaging to bank stability. There presence and extent is noted in the new sheets.

Parts 8 (7) to 10 (9) are unchanged in the new sheets, but Part 11 (10) has been extensively re-worked. The requirement to predict sedimentation trends has been removed. Often, berms are found only behind point bars in bendways. This fact can now be noted in anew section on Berm Location. Berm materials are now defined both by their Wentworth Scale classification and quantitatively through their size distribution. Berm vegetation is still described in detail, but a section on vegetation spacing has been added for consistency with Part 8 (7).

Parts 12 (11) to 16 (15) repeat the questions for the right bank of the channel.

1.3 Bank Erosion Assessment Sheet Testing

1.3.1 Fieldwork

Field testing of the Sedimentation Analysis Sheets was undertaken on Clear Creek, Mississippi with a group of 18 engineers from a wide variety of Corps Districts. The aim was to identify areas of weakness or ambiguity. Particular attention was paid to the complexity of the sheets and the potential for different groups working on the same reach of channel to supply different answers to the questions.

The class was divided into 6 groups of 3 people each. Because of time limitations (only 3 hours were available for the whole exercise) and the relative inexperience of the engineers in stream reconnaissance, it was not possible for each group to complete all three Sediment Analysis Sheets.

Instead, the 6 groups were arranged into 2 teams. Each team had each group fill out a single sheet. That is, Team A had its first group fill out the Valley and Channel Survey, its second group fill out the Left Bank Survey and its third group fill out the Right Bank Survey. Team B was arranged similarly. At the end of the reconnaissance the

groups pooled their results with the rest of their team. Consequently, 2 sets of completed sheets were obtained. The completed sheets are shown in Appendix C.

1.3.2 Discussion of Results

The results of the field testing of the sheets are included in Appendix D. These results are encouraging. There is general agreement between the two teams on most of the features of the valley, channel, bed and banks. In depth analysis of the results, together with the several pages of notes and detailed comments submitted by the short course students will take some time. By the Spring of 1991, the PI will have fully considered the results and further enhanced the sedimentation sheets accordingly. They will then be ready for the final development phase, field testing in a variety of rivers of different sizes, with different sedimentary environments and in different physiographic regions.

1.4 Bank Erosion Assessment Sheet Guideline Evaluation

The preliminary guidelines for application of the bank erosion assessment sheets developed by Thorne and Abt (1989) were evaluated in the light of critical comment from project reviewers at the University of Louisville and post-project input from engineers and scientists at the US Army Engineer Waterways Experiment Station. A start was made on incorporating photographs into the guidelines, but this was suspended when the scope of the sheets was increased from bank assessment to sedimentation analysis. Significant improvements were made and the guidelines for completion of the bank assessment sheets were rewritten in line with the modified sedimentation sheets. It is proposed to return to the incorporation of photographs into the guidelines in the Spring of 1991, once the scope and general form of the sheets has been finally decided.

1.5 Bank Erosion Assessment Sheet Guideline Testing

Field testing of the modified sedimentation sheet guidelines was undertaken on Clear Creek by the Sedimentation short course students. Particular attention was paid to ease of comprehension and clarity of statement in the guidelines.

The Corps engineers then briefed the PI and WES scientists regarding the strengths and weaknesses of the guidelines as they perceived them, and suggest changes and improvements as necessary. The intention is to us e these comments to

help produce a set of guidelines which is genuinely usable by non-specialist personnel, this is a fundamental aspect of the project.

1.6 Bank Erosion Assessment Sheet and Guideline Development

Work is now in hand to incorporate the experience gained and comments made in the October testing of the sheets and guidelines into an improved set of sheets and guidelines. These comments are listed in Appendix D. Over the winter steps will be taken to further develop the sheets and guidelines to produce an assessment system suitable for routine use nationwide by non-expert personnel.

2. RESEARCH PLANS

In the final phase, Phase 3, it is intended to complete development the sheets and guidelines on the basis of the direct field experience in a variety of physiographic environments. This part of the project will involve incorporating improvements, deleting extraneous sections, and optimizing the gathering of information, so that the resulting sheets and guidelines are both comprehensive and accurate, while being manageable and unambiguous. Phase 3 will be undertaken during May and June 1991. The latest version of the bank erosion assessment sheets will be field tested by the Principal Investigator together with the new engineer in charge of the bank erosion work unit from US Army Engineer Waterways Experiment Station, using field sites on a variety of rivers within the contiguous United States. It is planned to visit between 3 and 6 separate locations, working at several specific sites at each location. These locations and sites will be selected to include a wide range of river environments, in terms of the physiographic regions drained by the rivers, the size and morphology of the channels, the nature of the bed and bank materials, and, most particularly, the range of causes, processes and mechanisms involved in bank retreat. It is expected that, where appropriate, specialist and non-specialist engineers and scientists from local District Offices of the Corps of Engineers will accompany the PI and WES personnel into the field to assist in the on-site testing of the assessment sheets. The local knowledge so gained will be vital to in-depth testing of the sheets. The precise details of the locations, sites, participants and logistics is being worked out with WES staff.

The anticipated products are:

1. Tested and verified Bank Erosion Assessment Sheets to be used as an aid to field identification of:

- a) the state of vertical and lateral channel stability;
- b) the relation of local bank retreat to channel instability;
- c) the engineering and morphological characteristics of the banks;
- d) the dominant erosive forces and processes;
- e) the state of bank stability and the major failure mechanisms;
- f) the severity and extent of bank erosion in the reach; and
- g) the input parameters necessary for modeling bank retreat.
- 2. Documentation providing clear and detailed guidance on the use of the bank erosion assessment sheets for use by personnel who are not experts on bank erosion.

3. ADMINISTRATIVE ACTIONS

There have been no significant administrative actions during this period.

4. REFERENCES

- Biedenharn, D.S., Little, C.D., and Thorne, C.R. (1990) "Effects of low drop grade control structure on bed and bank stability" in, Hydraulic Engineering, H.H. Chang and J.C. Hill (Eds.), Proceedings of the National Conference on Hydraulic Engineering, ASCE, San Diego, August 1990, 826-831.
- Comes, B.M. (1990) "Identification techniques for bank erosion and failure processes" in, Hydraulic Engineering, H.H. Chang and J.C. Hill (Eds.), Proceedings of the National Conference on Hydraulic Engineering, ASCE, San Diego, August 1990, 193-197.
- Thorne, C.R. and Abt, S.R. (1989) "Bank Erosion Modeling and Assessment Techniques" Final Report to the US Army Engineers Waterways Experiment Station, under contract number DACW39-87-D-0031, Colorado State University, Ft Collins, Co., November 1989, 4 Parts.

APPENDIX A Revised Bank Erosion Assessment Sheets and Bank Erosion Sheet Guide-lines

SEDIMENTATION ANALYSIS SHEETS

and

GUIDELINES FOR THE USE OF SEDIMENTATION ANALYSIS SHEETS IN THE FIELD

Prepared for

US Army Engineer Waterways Experiment Station, PO Box 631 CEWES-HS, Vicksburg, Mississippi 39181

Ву

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October 1990

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* Note

page numbers refer to pages as they appear in the Original document, not their numbers in this Appendix.

SEDIMENTATION ANALYSIS SHEET Developed by Colin R. Thome for the US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

			· · · · · · · · · · · · · · · · · · ·		
RIVER		SITE		From REACH	То
SHEET COMPLETED BY		DATE	TIME: ST	CART 1	TIME: FINISH
	ep ér	TON 1 VALLEY AN	D CHANNEL CLERK	~	
PART 1: AREA ARO		TON 1 - VALLEY AN EY	D CHANNEL SURVE	. 1	
Terraia Mountains Uplands Hills Plains Lowlands	Geology Bed rock Moraine Glacio/Fluvial Fluvial Lacustrine Vind blown (losss)	Rock Type Cemented Clay Shale Limestone Sandstone Conglomerate Granite	Land Use Natural Cultivated Urban	Vegetation None Grass Arable Crops Shrubs Forest	Forest Type None Deciduous Coniferous Mixed
PART 2: VALLEY S	IDES				
Height < 20 feet 20-50 feet 50-100 feet >100 feet	Side Siope Angle < 30 degrees 30-60 degrees >60 degrees	Valley side Failures None Occasional Frequent	Severity of Problems Insignificant Moderate Serious	Failure Locations None Away from river Along river (Undercut)	Fallure Types None Shallow slide Rotational slip Slab-type Piping Flow failure
D. D. A. Lenner	PRI (PION OF OR				
PART 3: VERTICAL Present status II Adjusted Incised Aggraded Instability: Status Insignificant Moderate Serious	nstability:extent None Local General Reach scale System wide Regional scale	Terraces None Indefinate Fragmentary Continuous Number of terraces mber of Terraces er above valley Floor	Overbank Deposits None Site Fine sand Medium sand Coarse sand Gravel	Levees None Indefinate Fragmentary Continuous Levee Type Natural Man-made	Levee Data Height (f) Side Slope (o) Levee Failures None Occasional Frequent
PART 4: LATERAL P	ELATION OF CHA	NNEL TO VALLEY			
	nstability:extent None Local General Reach scale System wide Regional scale	Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tormous meanders Braided	Planform Data Bend Radius Meander belt width Wavelength Meander Sinuosity	Valley Floor Type None Indefinate Fragmentary Continuous	Valley Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note: th = channel top width
PART 5: CHANNEL	DESCRIPTION				
Dimensions Ave. top bank width Ave. channel depth Ave. water width Ave. water depth Reach slope Mean velocity Manning's n value	Flow Type None Uniform/Tranquil Uniform/Rapid Pool+Riffle Tumbling Step-pool	Bed Controls None Occasional Frequent Confined Number of controls Gra	Control Types None Bedrock Boulders Gravel armor Bridge aprons de control structures	Width Controls None Occasional Frequent Confined Number of controls	Control Types None Bedrock Boulders Gravel armor Revetments Bridge abutments dykes or groynes
PART 7: BED SEDIM	ENT DESCRIPTION	·	Bed Forms		
Bed Material Silt Sand Sand and gravel gravel and cobbles cobbles + boulders boulders + bedrock	Bed Armour None Static-armour Mobile-armour	Surface Size Data D50 (mm) D64 (mm)	Plane bed Ripples Dunes Bed form height (ft) Island or Bars None Occasional Frequent	Bar Types None Pools and riffles Alternate bars Point bars Mid-channel bars Diagonal bars Sand waves + dance	Bar Surface data D50 (mm) D84 (mm) sorting coef. Bar Substrate data D50 (mm) D84 (mm) sorting coef.

PART & LEGT BA	NK CHARACTERIST	SECTION 2 - LEFT	BANK SURVEY		
Type	Bank Materials M		Layer Thickness	Tension Cracks	Crack Extent
Noncobesive	Silt/clay	Average beight (ft)	Material 1 (ft)	None	Proportion of
Cohesive	Sand/silt/clay		Material 2 (ft)	Occasional	bank height
Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	
Layered	Send	Average angle (o)	Material 4 (ft)		
Even Layers	Sand/gravel		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
Thick+thin layers	Gravel	Distribution	and Description of	Bank Materials in Ban	k Profile
Number of layers	Gravel/cobbles	Material Type 1	Material Type 2		Material Type 4
	Cobbles	Tœ□	Tœ□	Toe	Toe
Protection Status	Cobbles/boulders	Mid-Bnak	Mid-Bnak	Mid-Bnak	Mid-Bnak
Unprotected	Boulders/bedrock	Upper Bank	Upper Bank	Upper Bank	Upper Bank
Hard points		Whole Bank	Whole Bank	Whole Bank	Whole Bank
Revetments		D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
Dyke Fields		sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
<u> </u>				·	
PART 9: LEFT BA	NK-FACE VEGETAT	TION			
Vegetation	Tree Types	Density	Location	Health	Helght
None□	None	None□	Whole bank	Healthy	Short
Cleared ☐	Alder	Sparce	Bank top	Fair	Medium
Grass and flora	Ash	Medium	Mid-bank	Poor	Tall
Reeds and sedges	Beech	Dense	Bank toe	Dead	
Shrubs	Birch				j
Saplings	Cottonwood	Spacing	Diversity	Age	Extent
Trees	Elm	Continuous	Mono-stand	Imature	Wide∏
		Close	Mixed Mixed	Mature	Medium
1	Sweet gum	Wide		Ord	
	wπow.□	W MODE	Climax-vegetation	OMIL	Narrow
L					
PART 10: LEFT RA	NK EROSION PRO	CESSES			
Status	Extent	Location	Processes	Distribution of Each	Process on Rank
Intact	Tœ□	General	Flow entrainment	Process 1	Process 2
Eroding	Lower bank	Outside Meander	Piping	Toe	Toe
1 "					—————————————————————————————————————
Advancing	Upper bank	Inside Meander	Freeze/thaw	Lower bank	Lower bank
	Whole bank	Opposite a bar	Sheet erosion	Upper bank	Upper bank
Severity	Estimated rate	Behind a bar	Rilling + gullying	Whole bank	Whole bank
Insignificant	< 3ft/yr	Opposite a structure	Wind waves	Process 3	Process 4
Mild_	3 - 10 ft/yr	Adjacent to structure	Vessel Forces	Toe	Toe 🔲
Significant	10 - 25 ft/yr∐	Dristream of structure	Ice rafting	Lower bank	Lower bank
Serious_	>25 ft/yr	Upstream of structure	Aeolian	Upper bank	Upper bank
Catastrophic		Other	Other	Whole bank	Whole bank
Dipt is true by	NY ELBURE MEG	VI + 1/1/00			
PART II: LEFT BA	NK FAILURE MEC	HANICS		Distribution of Each	Mode on Bank
Status	Extent	Location	Failure Mode	Mode 1	Mode 2
Stable	Toe				Toe [
		General	Shallow slide	Toe	
Unreliable	Lower bank	Outside Meander	Rotational slip	Lower bank	Lower bank
Unstable	Upper bank	Inside Meander	Slab-type	Upper bank	Upper bank
1	Whole bank	Opposite a bar	Pop-out failure	Whole bank	Whole bank
Severity	Frequency	Behind a bar	Cantilever failure	Mode 3	Mode 4
Intignificant	None	Opposite structure	Piping	Toe	Toe
Moderate	Occasional	Adjacent structure	Flow failure	Lower bank	Lower bank
Serious	Frequent	Dristream of structure	Ravelling	Upper bank	Upper bank
_		Upstream of structure	_	Whole bank	Whole bank
		CONTRACT CO			
PART 12: LEFT BA				.	we
Present Status	Berm Materials		Berm Tree Types	Density	Health
No berm	Silt/clay	None	None	None	Healthy
small berm	Sand/silt/clay	Cleared	Alder	Sparce	Unhealthy
medium berm	Sand/silt	Grass and flora	Ash	Medium	Dead [
large berm	Sand	Reeds and sedges	Birch	Dense	
Berm Location_	Sand/gravel	Shrube	Cottonwood	Diversity	Height_
None	Gravel	Saplings	Elm	Mono-stand	Short
Only inside bends	Gravel/cobbles	Trees	Beech	Mixed	Medium
			·		—
Continuous	Cobbles		Sweet gum i i	Climax-vegetation	Tell
Continuous Berm Material		Acc	Sweet gum		
Berm Material	Cobbles/boulders	Age	Willow	Spacing	Roots
Berm Material Size Data	Cobbles/boulders Boulders	Imature		Spacing Continuous	Roots Normal
Berm Material	Cobbles/boulders		Willow	Spacing	Roots

		SECTION 3 · RIGHT	BANK SURVEY		
PART 13: RIGHT	BANK CHARACTER	ISTICS		-	
Type	Bank Materials M	ean Bank Height	Layer Thickness	Tension Cracks	Crack Extent
Noncohesive	Silt/clay	Average height (ft)	Material 1 (ft)	None	Proportion of
Cohesive	Sand/silt/clay	At teringe mangain (m)			
			Material 2 (ft)	Occasional	bank height
Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	
Layered	Sand	Average angle (o)	Material 4 (ft)		
Even Layers	Sand/gravel				
Thick+thin layers	Gravel	Distribution	n and Description of	Bank Materials in Ban	k Profile
Number of layers	Gravel/cobbles		Material Type 2		
Number of myers		Material Type 1			faterial Type 4
	Cobbles	Toe	Toe	Toe	Toe
Protection Status	Cobbles/boulders	Mid-Bnak	Mid-Bnak	Mid-Bnak	Mid-Bnak
Unprotected	Boulders/bedrock	Upper Bank	Upper Bank	Upper Bank	Upper Bank
Hard points		Whole Bank	Whole Bank	Whole Bank	Whole Bank
				—	
Revetments		D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
Dyke Fields		sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
		_	_		
PART 14: RIGHT	BANK-FACE VEGET	ATION			
			N =	** *	
Vegetation	Tree Types	Density	Location	Health	Height
Nane	None	None	Whole bank	Healthy	Short
Cleared	Alder	Sparce	Bank top	Fair	Medium
Grass and flora	Ash	Medium	Mid-bank	Poor	Tall
					1 mm
Reeds and sedges	Beech	Dense	Bank toe	Dead	
Shrubs	Birch		_		
Saplings	Cottonwood	Spacing	Diversity	Age	Extent
Trees	Elm	Continuous	Mono-stand	Imature	Wide□
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	—			<u></u>	
	Sweet gum	Close	Mixed	Mature	Medium
	Willow	Wide	Climax-vegetation	OPT .	Narrow
				_	_
PART 15: BIGHT	BANK EROSION PR	OCESSES			
			_		
Status	Extent	Location_	Processes	Distribution of Each	Process on Bank
Intact	Toe [General	Flow entrainment	Process 1	Process 2
Eroding	Lower bank	Outside Meander	Piping	Tœ□	Toe 🗂
Advancing	Upper bank	Inside Meander	Freezethaw	Lower bank	Lower bank
7,012,101,2		—			
	Whole bank	Opposite a bar	Sheet erosion	Upper bank	Upper bank
Severity	Estimated rate	Behind a bar	Rilling + gullying		Whole bank
· —			Rilling + gullying	Whole bank	Whole bank
Insignificant	< 3ft/yr□	Opposite a structure	Wind waves	Whole bank Process 3	Process 4
Insignificant Mild	< 3ft/yr 3 - 10 ft/yr 3	Opposite a structure Adjacent to structure	Wind waves Vessel Forces	Whole bank Process 3	Process 4
Insignificant	< 3ft/yr□	Opposite a structure Adjacent to structure Distream of structure	Wind waves	Whole bank Process 3	Process 4
Insignificant Mild	< 3ft/yr 3 - 10 ft/yr 3	Opposite a structure Adjacent to structure	Wind waves Vessel Forces Ice rafting	Whole bank Process 3 Toe Lower bank	Process 4 Toe Lower bank
Insignificant Mild Significant Serious	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Whole bank Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure	Wind waves Vessel Forces Ice rafting	Whole bank Process 3 Toe Lower bank	Process 4 Toe Lower bank
Insignificant Mild Significant Serious	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Whole bank Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant Serious Catastrophic	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Whole bank Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant Serious Catastrophic	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Whole bank Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant Serious Catastrophic	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Whole bank Process 3 Toe Lower bank Upper bank	Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant Serious Catastrophic	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr	Opposite a structure Adjacent to structure Dustream of structure Upstream of structure Other CHANICS	Wind waves Vessel Forces Ice rafting Acolian Other	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each	Toe Toe Lower bank Upper bank Whole bank Whole bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr SANK FAILURE ME	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location	Wind waves Vessel Forces Ice rafting Aeolian Other	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1	Process 4 Toe Lower bank Upper bank Whole bank Whole bank Mode on Bank Mode 2
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT Status Stable	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General	Wind waves Vessel Forces Ice rafting Aeolian Other Fallure Mode Shallow slide	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe	Toe Toe Toe Toe Toe Toe Toe Toe Toe
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable	<pre>< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank</pre>	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander	Wind waves Vessel Forces Ice rafting Aeolian Other	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1	Process 4 Toe Lower bank Upper bank Whole bank Whole bank Mode on Bank Mode 2
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT Status Stable	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General	Wind waves Vessel Forces Ice rafting Aeolian Other Fallure Mode Shallow slide	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe	Toe Toe Toe Toe Toe Toe Toe Toe Toe
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable	<pre></pre>	Opposite a structure Adjacent to structure Dustream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank	Toe Lower bank Whole bank Mode 2 Lower bank Upper bank Whole bank Upper bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT Status Stable Unreliable Unstable	<pre>3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >BANK FAILURE ME Extent Too Lower bank Upper bank Whole bank</pre>	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Upstream of structure CHANICS Location General Outside Meander Inside Meander Opposite a bar	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank	Mode on Bank Mode 2 Toc Lower bank Upper bank Whole bank Mode 2 Toc Lower bank Upper bank Whole bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT Status Stable Unreliable Unstable Severity	3 - 10 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Inside Meander Opposite a bar Behind a bar	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Mode 3	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Mode 4
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant	<pre> <3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency Nome </pre>	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe	Mode on Bank Whole bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Upper bank Upper bank Toe Lower bank Toe Toe
Insignificant Mild Significant Serious Catastrophic Status Stable Unreliable Unstable Severity Insignificant Moderate	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Mode 3	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Mode 4
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Mode 3 Toe Lower bank	Mode on Bank Mode 2 Lower bank Upper bank Whole bank Mode 2 Lower bank Upper bank
Insignificant Mild Significant Serious Catastrophic Status Stable Unreliable Unstable Severity Insignificant Moderate	<pre>3 flyr 3 - 10 ftyr 10 - 25 ftyr >25 ftyr >25 ftyr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent</pre>	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 4 Toe Lower bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate	<pre>3 flyr 3 - 10 ftyr 10 - 25 ftyr >25 ftyr >25 ftyr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent</pre>	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Mode 3 Toe Lower bank	Mode on Bank Mode 2 Lower bank Upper bank Whole bank Mode 2 Lower bank Upper bank
Insignificant Mild Significant Serious Catastrophic Status Stable Unreliable Unstable Severity Insignificant Moderate	<pre>3 flyr 3 - 10 ftyr 10 - 25 ftyr >25 ftyr >25 ftyr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent</pre>	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 4 Toe Lower bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate Serious	<pre> <3f\/yr 3 - 10 f\/yr 10 - 25 f\/yr >25 f\/yr >25 f\/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent </pre>	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 4 Toe Lower bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate Serious	<pre>3 flyr 3 - 10 ftyr 10 - 25 ftyr >25 ftyr >25 ftyr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent</pre>	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 4 Toe Lower bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate Serious	3 - 10 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Upper bank Whole bank	Mode on Bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Whole bank Whole bank Whole bank Whole bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT I Present Status	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure Upstream of structure Upstream of structure ACTERISTICS Berm Vegetation	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Upper bank Whole bank	Toe Lower bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Upper b
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT I Present Status No berm	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency Nome Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure Opposite structure Upstream of structure Upstream of structure Opposite structure Upstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None	Whole bank Process 3 Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Whole bank Node 3 Toe Lower bank Upper bank Upper bank Upper bank Whole bank	Toe Lower bank Whole bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Whole bank Upper bank Whole bank Whole bank Upper bank Whole bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent SANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure Upstream of structure Cleared	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder	Whole bank Process 3 Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Upper bank Whole bank Upper bank Whole bank	Toe Lower bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Upper b
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT I Present Status No berm	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency Nome Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure Opposite structure Upstream of structure Upstream of structure Opposite structure Upstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None	Whole bank Process 3 Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Whole bank Node 3 Toe Lower bank Upper bank Upper bank Upper bank Whole bank	Toe Lower bank Whole bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Whole bank Upper bank Whole bank Whole bank Upper bank Whole bank
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm medium berm	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent SANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Cleared Grass and flora	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Upper bank Whole bank Whole bank Whole bank Mode 3	Toe Lower bank Whole bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Whole bank Hode 4 Toe Lower bank Upper bank Whole bank Upper b
Insignificant Mild Significant Serious Catastrophic Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm medium berm large berm	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay Sand/silt/sand	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Constructure Upstream of structure Constructure Construc	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Whole bank	Toe Lower bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Upper b
Insignificant Mild Significant Serious Catastrophic Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm medium berm large berm Berm Location	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency Nome Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay Sand/silt/say Sand/silt	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Grass and flora Reeds and sedges Shrubs	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood	Whole bank Process 3 Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Upper bank	Toe Lower bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Upper b
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT I Present Status Status Serious I Status Serious I Seriou	3 flyr 3 - 10 ftyr 10 - 25 ftyr 10 - 25 ftyr >25 ftyr >25 ftyr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sank Sank BERM CHAR Berm Materials Silt/clay Sand/silt/clay Sand/silt Sand/sravel Gravel	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure Upstream of structure Upstream of structure Cleared Grass and flora Reeds and sedges Shrubb Saplings	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Whole bank Whole bank Whole bank Deans Whole bank Upper ban	Toe Lower bank Whole bank Upper bank Upper bank Whole bank Upper bank Upper bank Upper bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Whole bank Upper b
Insignificant Mild Significant Serious Catastrophic Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm medium berm large berm Berm Location	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency Nome Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay Sand/silt/say Sand/silt	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Grass and flora Reeds and sedges Shrubs	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood	Whole bank Process 3 Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Upper bank	Toe Lower bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Upper b
Insignificant Mild Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT I Present Status Serious I	3 flyr 3 - 10 ftyr 10 - 25 ftyr 10 - 25 ftyr >25 ftyr >25 ftyr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sank Sank BERM CHAR Berm Materials Silt/clay Sand/silt/clay Sand/silt Sand/sravel Gravel	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure Upstream of structure Upstream of structure Cleared Grass and flora Reeds and sedges Shrubb Saplings	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Upper bank	Toe Lower bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Whole bank Whole bank Upper bank
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GUIDELINES ON THE USE OF SEDIMENTATION ANALYSIS SHEETS IN THE FIELD

1. BACKGROUND

1.1 Introduction

The nature and causes of sedimentation problems are often difficult to identify in the field. Even quite experienced river engineers and fluvial geomorphologists find it hard to describe the dominant sedimentary forms and features accurately. This is the case because sedimentation problems may result from a wide variety of dynamic channel processes, some operating at local scales, others at reach scales, and still others associated with instability of the entire fluvial system throughout the drainage basin.

Sediment erosion, transport and deposition usually takes place during high flows and it is not usually possible to observe these processes directly. Any opportunity to observe the river at high flow should be taken, as invaluable insights into sedimentation processes can be gained. However, often this simply is not possible.

Thus, during a site visit, the appearance of the channel, its geomorpholgical setting and the sedimentary forms and features must be used to infer the types of processes operating during channel forming flows, and judge the nature and severity of sediment related problems. The state of the channel on any particular visit depends to some extent on the sequence of erosion, failure and clean-out events in the days, weeks and months prior to the visit. Also, the cyclical nature of some sedimentary processes can produce a deceptive of stability in a changing channel. For example, continued bank erosion may occur by a cycle of flow under-cutting, mass failure and basal clean-out. This can produce parallel retreat, with little change in bank geometry over time. Consequently, a channel bank may appear unchanged on consecutive visits to a site, even though it has retreated substantially between the two visits. This is the case if it is at about the same stage of basal clean-out when the visits are made, there having been one or more mass failures in between. At first it appears that the bank has not moved since the previous visit, the actual retreat only becoming apparent when the position of the bank relative to fixed points or baselines is established. If such reference marks are not available it is all too easy to under-estimate the rapidity and severity of erosion and retreat.

Consequently, the channel and its surroundings must be examined carefully if it is to yield reliable pointers to the true nature of the dominant sedimentation forms and features, sedimentary processes, the impact of sediment problems and the resulting state of stability or instability. Usually the information necessary to make reliable estimates and interpretations is there, but the observer must know how and where to look for it.

The sedimentation analysis sheets presented here are an attempt to provide some assistance in examining alluvial streams, gathering the descriptive data necessary to characterize them, identifying the sediment processes and mechanisms, and estimating the severity of any problems. Only after these steps have been taken will it be possible to determine the cause of the problems with any confidence and make sound recommendations concerning remedial measures.

The sheets are not intended as a substitute for a conventional hydrographic, hydraulic and geotechnical survey of the site. Rather they are a fore-runner of such surveys and, being made over a wider area, they should allow any subsequent quantitative work to be targeted on critical areas to increase efficiency.

1.2 Overall Structure of the Sheets

The sheets are set out in three major sections, each on a separate page. Section 1 - Valley and Channel Survey deals with the broadest scale. The aims are: first to define the geologic, geomorphic and human environment around the channel, particularly by establishing the relationship between the river channel and its valley; second to establish a clear picture of the channel in terms of its characteristic dimensions, plan geometry, flow type, and bed and bar sediments; and third to determine the nature of the instability problem both in terms of severity and spatial extent. Reference is made here to vertical and lateral channel instability rather than just instability, because it is vital at this early stage to identify whether the direction of channel instability is in the vertical plane, horizontal plane, or both.

Section 2 - Left Bank Survey deals in greater detail with all aspects of bank assessment for the left bank. The aim is to establish a clear picture of the bank in terms of its characteristic geometry and materials, vegetation, erosion processes, failure mechanisms, and state of toe sediment balance. It is split into 5 parts dealing with each of these

topics. Section 3 - Right Bank Survey repeats the survey for the other channel bank and completes the assessment.

1.3 Application of the Assessment Sheet Data

At present the data collected in the sedimentation analysis may be used in two ways. First, it may be addressed qualitatively by engineers and geomorphologists interested in establishing the channel characteristics and sediment impacts before making recommendations regarding the best approach to mitigating or preventing continued problems of channel sedimentation or instability. In this context, the sheets could form a useful component in the analysis of current river processes, instability and the prediction of river response to changes in flow regime or sediment transport. Use of the sheets would form part of the initial engineering/geomorphic analysis that is strongly recommended by most experts (see for example: Simons, Li and Associates, 1982; Schumm et al., 1984).

Second, the assessment sheets could be used to supply most of the input data required for the SAM approach to stable channel design being developed by WES (Thomas, 1990).

In this respect, the framework established here for characterizing the channel, its morphology and its sediments should be very useful in determining the applicability of the different equations for flow resistance, sediment transport and one-dimensional modeling. On this basis, the most appropriate quantitative approach to be used can be selected.

The sheets have the potential to form the input data for a computerized expert system on sedimentation analysis. To develop such a system is beyond the scope of the present project, but experience gained in the development and use of the field sheets should be very useful should such systems be developed in the future.

2. GUIDELINES FOR COMPLETING THE SHEETS

2.1 Introduction

In this section detailed guidance is given on how to fill-out the Sedimentation Analysis Sheets in the field. References to particular sections, parts and topics in the sheets are put in italics.

2.2 Section 1 - Valley and Channel Survey

This section deals with the geologic setting, geomorphic features and sedimentary characteristics of the river channel and its valley. It is essential to establish in order that sedimentation problems can be seen in the context of the general fluvial and sedimentary environment.

More particularly, it is important to establish any causal links between large-scale fluvial processes and sediment impacts at the outset, and to identify the severity and extent of any underlying instability in the fluvial system. Often the particular problem to be addressed in an analysis, such as bank erosion or bed aggradation, is just one manifestation of system instability and it should not then be treated in isolation if it is to be properly understood and dealt with.

This section is divided into 6 parts. Each is now dealt with in turn.

Part 1: Area around River Valley

Has six topics. The aim is to characterize the surrounding land in terms of terrain, geology, rock type, land-use, vegetation and forest type.

Terrain defines the type of land-scape within which the river valley is located. Generally, the greater the topography the more energy is available to do geomorphic work and the more rapid and pronounced will be terrain response to natural instability, or human-induced destabilisation.

Geology deals with the origin of the surficial materials making up the land-scape. Erosion resistance is directly related to surficial geology and this will strongly affect the susceptibility of the area to geomorphic processes and related sediment impacts.

Rock Type defines the composition of the sub-surface materials. Erosion resistance and sediment yield (both volume and calibre) are also affected by the rock type.

Land-use addresses the type of human activity taking place in the area around the valley. Generally, cultivated areas have higher run-off potential and sediment yields than natural catchments. Urban catchments produce flashy run-off hydrographs and altered sediment yields.

Vegetation plays an important role in catchment processes generating run-off and sediment yield. It is useful to know the types of vegetation in the catchment around the valley in order to gauge its influence on present catchment hydrology and sediment processes, and the potential for changes induced by changing land-use.

Forest Type has been shown to be an especially significant aspect of catchment vegetation in affecting catchment

hydrology, soil stability and sediment production. The effects of coniferous versus deciduous forest are rather different, coniferous forests generally producing higher run-off and sediment yield due to the lack of a vegetative under-storey and the existence of drainage ditches and access roads, especially in plantations.

Part 2: Valley Sides

Has 6 topics. The aim is to define the scale, geometry, stability and mode of failure (if any) of the valley side slopes.

Height and Side Slope Angle define the scale and geometry of the valley sides. High and/or steep valley sides have the potential to be destabilized and to trigger system wide instability to the fluvial system.

Failures records whether the slopes are stable, or prone to occasional or frequent failures. Valley wall failures indicate lateral geomorphic activity, and possibly valley widening.

Severity of Problems indicates the level of activity of valley side wall failures. Severely unstable valley walls would be expected to be a major source of sediment in the fluvial system.

Failure Locations indicates whether failures are adjacent to, or remote from, the river channel. This critically important because it determines the relationship between the river and the failures, and indicates how sediments derived from valley side failures are delivered to the river. Failures occurring away from the river are not a direct result of river erosion. Sediments generated by such failures are stored as at the base of the slope for long periods (these deposits are called colluvium by geomorphologists).

They then either make their way to the river by very slow processes, such as soil creep, or are eroded during catastrophic floods - which occur only rarely. These failures are <u>uncoupled</u> from the fluvial system. Conversely, failures adjacent to the river are <u>coupled</u> directly to river erosion. They are triggered by flow undercutting and deliver large volumes of debris directly into the channel. Such failures may be considered to be bank erosion at the largest scale and may pose serious problems in terms of system stability, land loss and sediment yield.

Failure Types defines the mode of valley side failure. The type of failure determines the shape of the valley sided after failure, controls the volume of material involved in each failure and may help to identify the cause of the instability.

Part 43 Vertical Relation of Channel to Valley

This part has 10 topics. The aim is to establish the present relationship between the channel and its valley in terms of vertical relation, the dynamic nature of that relationship, and the existence of any landforms associated with vertical instability.

Present Status defines whether the river is currently adjusted to the present valley elevation (graded) or whether it is either incised (entrenched), or aggraded (numerous bars and islands, with a poorly defined channel). Incised rivers rarely flood, flow being concentrated in-channel even at very high discharges. They tend to have low width to depth (aspect) ratios and erode their banks through undercutting and mass failure. Aggrading rivers often flood, depositing sediment onto their flood plains (valley floors) They have high aspect ratios and widen through bank erosion by direct entrainment of bank material by the flow.

Instability: Status defines the severity of any vertical instability. This helps to put any sediment impacts associated with aggradation or degradation into perspective and is a first step towards prioritising channel instability problems in terms of urgency of stabilization.

Instability: extent defines the scale of vertical instability in the river. It is important at the outset to establish whether instability is a local, general or regional phenomenon. Usually, this is an essential step in identifying the underlying cause of a channel instability problem. It is also usually necessary to match the scale of the solution to the scale of the problem.

Terraces are fluvial landforms produced by vertical instability in the fluvial system. A terrace is a remnant of a former flood plain of the river, left which is no longer subject to inundation. It may be identified in the field as a strip of almost level ground above the elevation of the contemporary flood plain, and separated from that flood plain by a steeper scarp or slope. Terraces give the valley cross-profile a stepped appearance.

Number of Terraces records how many terraces may be identified. The theory of complex response shows how several terraces may be produced by a single destabilization of the system, as the river hunts for a new graded profile. The number of terraces indicates the nature and degree of past vertical instability and demonstrates the potential of the system for dynamic vertical activity.

Overbank Deposits notes the presence and size of material deposited directly onto the valley floor by out of bank flows. This information gives an idea of the frequency, magnitude and energy level of overbank flow.

Levees are produced by over bank sedimentation along the river during flood flows because the greatest amount of sediment tends to fall out of transport closer to the river. Well developed natural levees indicate a river with a heavy load of suspended sediment and frequent over-bank flooding. Man-made levees are constructed to contain flood flows are protect the area behind them from inundation. The presence of man-made levees indicates that the river is prone to frequent flooding in its natural state.

Levee Type indicates whether any levees present are natural or man-made.

Levee Data records the height and side slope angle of any levees present.

Levee Failures identifies the stability status of any levees present.

Part 4: Lateral Relation of Channel to Valley

This part has 7 topics. The aim is to establish the present relationship between the channel and its valley in terms of lateral relation, the dynamic nature of that relationship, the channel planform geometry and the nature and width of the valley floor.

Present Status defines whether or not the channel width is adjusted to the present flow regime. Adjusted channels have stable widths over time, although they may still evidence erosion of one bank and deposition at the other if they are laterally active. This is termed 'dynamic equilibrium'. Overwide rivers are broad and shallow with shifting bars. They tend to have berms of accumulated sediment at both banks, producing a composite cross-sectional shape. Narrow rivers have low aspect ratios, no berms and more rectangular cross-sections.

Instability: Status defines the severity of any lateral instability. This helps to put any sediment impacts associated with bankline retreat and lateral shifting into perspective and is a first step towards prioritising channel instability problems in terms of urgency of stabilization.

Instability: extent defines the scale of lateral instability in the river. It is important at the outset to establish whether instability is a local, general or regional phenomenon. Usually, this is an essential step in identifying the underlying cause of a channel instability problem. It is also usually necessary to match the scale of the solution to the scale of the problem.

Planform describes the geometry of the channel when viewed from above. It uses the usual classification of rivers as being straight, meandering or braided. For single thread

channels, sinuous channels are is the transition between straight and meandering. They have alternate bars and cutbanks opposite leading to curved flow, but have not yet attained a truly meandering course. Irregular meanders lack the symmetry of regular or classical meanders and usually indicate that the planform is being influenced by outcrops of erosion resistant materials in the banks. Tortuous meanders are highly convoluted and experience neck cut-offs. Braided rivers are very wide and shallow with divided flow around medial bars.

Planform Data records the characteristic dimensions of channel meanders. Bend radius measures the tightness of the bends in terms of the radius of a circle approximately following the channel centerline. Meander belt width is the width of the belt regularly swept by the channel as bends migrate downstream. Wavelength is twice the long valley distance between crossings (meander inflection points). Meander sinuosity is the ratio of channel length to straight line valley length between crossings.

Valley Floor Type establishes the existence and nature of the alluvial surface surrounding the river. If this is narrow and/or discontinuous then the potential exists for the river to destroy the flood plain bottom lands and attack the terraces and valley side slopes directly, potentially leading to severe instability of the whole valley system.

Valley Floor Data records the width of the valley floor relative to that of the channel.

Part 5: Channel Description

This part has 6 topics. The aims are to characterize the channel in terms of its dimensions, flow regime and geologic, sedimentary or man-made controls on bed scour and bank retreat. This supplies the basic information needed by a hydraulic engineer or geomorphologist to represent the river and its channel in terms of flow and potential for instability.

Dimensions gives an approximate guide to the size and shape of the channel in terms of the standard hydraulic geometry parameters such as average top bank width, average water surface width, average channel and water depths, reach slope, estimated mean velocity, and Manning's n.

Flow Type defines the regime of flow in the channel according to the principles of free surface flow. Uniform flow lacks major changes in flow velocity with distance along the channel. Tranquil flow is sub-critical, shooting flow supercritical. Pools and riffles are areas of deep and shallow flow

respectively, which produce non-uniform flow. Tumbling flow occurs in steep streams with large bed material which disrupts the water surface and produces locally super-critical flow. Step-pool flow is found in very steep channels with boulders arranged in periodic steps across the channel and pools in between.

Bed Controls set limits on the degree of vertical instability allowed by the local geology, materials and/or human intervention. A control is a feature which is not easily eroded by the river, thereby preventing continued instability.

Control Types defines the nature of the bed controls. Examples are bed rock outcrops, coarse sediments which form an armor layer in the bed, and fine sediments which are strongly cohesive. Where natural controls like these are absent, weirs or cut-off walls may be constructed to prevent bed degradation. Such grade control structures are a vital where degradation may occur and natural controls are either absent or unreliable. Aprons constructed at bridges and culverts may also act as grade controls.

Width Controls set limits on the degree of widening and/or lateral migration allowed by the local geology, materials and human intervention. A control is a feature which is not easily eroded by the river, thereby preventing continued lateral erosion. Where natural controls are inadequate man-made structures such as revetments or dykes may be used to prevent bankline movement. Lateral shifting may also be constrained at bridge crossings.

Control Types define the nature of the width controls. Examples are bed rock outcrops, coarse sediments which form an armour layer on the bank, and fine sediments which are strongly cohesive. Controls due to fine sediments are often associated with clay plugs and back swamp deposits in the flood plain left by earlier depositional activity. Where natural controls like these are inadequate, dyke fields and/or revetments may be used to control river width, and bankline movement. Such training structures are a vital part of bank protection schemes in systems where width is unstable and natural controls are either absent or unreliable.

Part 7: Bed Sediment Description

This part has 10 topics. The aims are to characterize the sediments in the bed and bars of the channel in terms of their types, stratigraphy, depth, size distributions, bed forms, bar types. This supplies the basic information needed by a hydraulic engineer or geomorphologist to represent the river sediments

when calculating sediment transport and potential for bed instability.

Bed Material characterizes the bed sediment of the river. It is recognized that their are fundamental differences in the flow and sedimentary regimes and responses of rivers with markedly different bed materials.

Bed Armor verities whether a coarse surface layer is present. Armoring plays a vital role in determining the availability of bed sediments for transport by the flow. The armor may be static - that is immobile under all but catastrophic flood flows, or mobile - that is mobile at flows below bankfull discharge.

Sediment Depth records the depth of loose sediment in the bed of the channel. This gives a guide to the size of the reservoir of sediment stored in the channel and available for transport by the flow. Degrading channels have very thin bed sediment thicknesses, while aggrading channels have great thicknesses.

Surface and Substrate Size Data are based on size analyses of bed material samples taken at a representative point in the bed. This should be at about mid-channel in a crossing, away from obvious bar and island features. A separate substrate sample is only necessary if an armor layer is present.

Bed Forms notes the presence and type of bed forms in the bed of the channel. Bed forms are very important in producing form roughness which increases the Manning's n for a channel and play a significant role in the movement of sediment as bed load.

Islands or bars accounts for the presence of divided reaches in the flow. Divided flows are generally less hydraulically efficient than single channel flows. Islands and bars have important impacts on flow resistance and channel capacity.

Bar Types describes the morphology of any bars. Bars represent major topographic features in the channel bed and are intimately related to flow patterns and sediment transport distributions. They are often responsible for diversion of the flow so that it attacks one or both banks, promoting erosion, basal scour and bank retreat.

Bar Surface and Substrate Data are based on size analyses of bar material samples taken at a representative point on the bar. This should be at about mid-bar, away from obvious bar head and bar tail. A separate substrate sample is only necessary if an armor layer is present. Bars are often the primary source of sediment for transport by the river, especially in rivers with armored beds.

2.3 Section 2 - Left Bank Survey

This section describes in detail the character, vegetation, erosion processes, failure mechanics and toe-sediment balance for the left bank. It is divided into 5 parts, dealing with each of these aspects in turn. A complete and thorough evaluation of the bank and its dynamics lies at the heart of the field inspection and forms the basis for the explanation of bankline retreat and the establishment of the best approaches to modeling erosion processes and selecting stabilization strategies.

It is very important that the user complete each section independently of the information gathered in other sections. For example, the status of bank stability with regard to mass failure is not addressed until Part 11. Users should not allow the presence or absence of failures influence their selections in parts 8 to 10 which do not deal with bank failures but with other characteristics and processes.

Berms are basal accumulations of sediment at the toe of the bank. They are an important morphological feature of alluvial channels and are dealt with in part 12, separately from the intact bank.

Part 8: Left Bank Characteristics

This part contains 12 topics. The aim is is characterize the left bank in terms of its approximate dimensions, geometry, materials and stratigraphy. All of these characteristics are of fundamental importance to bank erosion, failure and stabilization.

Type establishes the overall classification of the bank as being noncohesive, cohesive, composite or layered. Research on bank erosion has illustrated basic differences between banks formed in different materials, or combinations of materials. Noncohesive banks are formed in sands, gravels, cobbles and boulders that lack any intrinsic cohesion. Cohesive banks are formed in silts and clays which are cohesive. Composite banks consist of a single cohesive layer underlain by a single noncohesive layer. Such banks are common in rivers with noncohesive bed material (sand or gravel) which are flowing through alluvial flood plain deposits consisting of bed material overlain by overbank fines deposits. Layered banks consist of layers of noncohesive and cohesive materials laid down during a past aggradational phase. Often the layers are of uneven thickness and this can be very significant to bank erosion and hydrology.

Protection Status Bank establishes whether the bank is unprotected or has been subject to engineering stabilization.

Bank Materials details the composition of the bank in terms of the characteristic types of sediment for up to four materials that make up the bank. This supplies vital information on the nature of the bank materials for interpreting bank erosion and failure processes.

Mean Bank Height and Mean Bank Slope records the approximate parameters necessary to define the size and steepness of the bank.

Layer Thickness records the thickness of each stratigraphic unit making up the bank.

Tension Cracks notes whether there are tension cracks behind the bank. Tension cracks develop vertically down from the ground surface behind steep banks and greatly reduce the stability of the bank with respect to mass failure.

Crack Extent records the depth of tension cracking as a proportion of the total bank height.

Distribution of Bank Materials in Bank Profile (Material Types 1 - 4) defines the distribution of the bank materials through the bank. This can be of crucial importance. For example, the occurrence of a weak, noncohesive layer close to top of a layered bank is of little consequence, but that same layer at the toe would lead to rapid undermining and failure.

Part 7: Left Bank Vegetation

This part has 10 topics. The role of bank vegetation in affecting bank processes and stability has been recognized by engineers and geomorphologists alike. Vegetation effects may be either beneficial or detrimental to bank stability depending on the nature of the vegetation and the geomorphic environment. It is therefore necessary to for vegetation to be covered in some detail in the description of the bank.

Vegetation at the broad scale classifies the types of flora found on the bank.

Tree Types recognizes that particular species of tree are more or less effective in stabilizing the bank, while others often cause instability.

Density describes the degree of vegetative cover over the bank face. Particularly, it refers to the relative percentages of bare soil versus that covered by plants. The higher the density, the better the vegetative protection, but also the greater the flow retardance.

Spacing describes how the vegetation is spread over the bank. Particularly, it refers to whether there are clumps of vegetation with spaces in between which the flow might attack,

or whether there is an close spacing of plants. It differs from density. For example, it is quite possible for dense vegetation to be growing in widely spaced clumps with bare spaces in between.

Location defines the position of the vegetation on the bank profile. Generally, vegetation at the bank top is less effective in stabilizing the bank than that lower on the bank.

Diversity deals with the mix of vegetative types present. Generally a mature ecosystem is more beneficial than a monostand.

Health identifies the state of the vegetation. Dead or dying vegetation quickly becomes a serious liability to bank stability.

Age can be a useful guide to the history of the bank. Mature vegetation clearly can only develop on a stable bank, while a predominance of young, immature vegetation hints at recent instability.

Height is a factor in determining the effect of vegetation in dragging down the bank and in impeding near bank flow in the channel. Tall trees may drag down a section of bank by toppling into the channel through either their surcharge weight or due to wind-throw.

Extent describes the width of the band of bank vegetation along the channel. It refers to how extensive the band of vegetation is in relation to the riparian corridor. A wide, extensive band produces a buffer zone along the bank which isolates it from the flood plain and has many advantages to the bank environment and its stability. A narrow band is grazed on the bankward side only, producing asymmetrical trees and bushes which lean over into the channel and are vulnerable to destabilization by wind-throw.

Part 10: Left Bank Processes

This part has 10 topics. The aim is to develop a good understanding of the process responsible for erosion and their distribution over the bank, both along the channel and up and down the bank profile.

Status establishes whether the bank is intact, eroding or advancing (due to sediment deposition).

Severity puts any erosion into perspective. Nearly all rivers have some bank erosion, but by no means all merit analysis or treatment.

Extent locates the erosion over the bank profile. Generally, toe erosion is most serious to overall bank retreat potential.

Estimated Rate gives a general idea of the seriousness of the problem. The rate may be estimated using historical information (maps, aerial photographs), reference to the position of the bank relative to fixed points on repeated visits, or sound local knowledge from a reliable source. In this respect the opinions of the land owner should be accepted with caution and checked against independent estimates.

Location establishes the position of the eroding area in relation to major channel features. These may, or may not, be the cause of the problem.

Processes attempts to identify the erosive processes responsible. This is not an easy task and often requires some training. It is assumed here that the individuals undertaking the survey are somewhat familiar with erosion processes and recognition of the effects of different processes on the bank surface. Some guidance is necessary though:

<u>Flow entrainment</u> is the detachment and removal of intact grains or aggregates of grains from the bank face by the flow. Evidence includes: impingement of high velocity flow against the bank; a fresh, ragged appearance to the bank face; undercutting of the toe/lower bank relative to the bank top; a lack of surficial bank vegetation.

Piping is the caused by groundwater seeping out of the bank face. Grains are detached and entrained by the seepage flow (termed sapping) and may be transported away from the bank face by surface run-off generated by the seepage, if their is sufficient volume of flow. Evidence includes: pronounced seep lines, especially along sand layers or lenses in the bank; pipe shaped cavities in the bank, notches in the bank associated with seepage zones, run-out deposits of eroded material on the lower bank or berm. Note that the effects of piping erosion can easily be mistaken for those of wave and vessel force erosion.

<u>Freeze/thaw</u> is caused by sub-zero temperatures which promote freezing of the bank material. Ice wedging cleaves apart blocks of soil. Needle-ice formation loosens and detaches grains and crumbs at the bank face. Evidence includes: periods of below freezing temperatures in the river valley; jumbled blocks of bank material; a loose crumbling appearance to the bank surface; loosened crumbs accumulated at the foot of the bank after a frost event.

<u>Sheet erosion</u> is the removal of a surface layer of soil by non-channelized surface run-off. It results from surface water drainage over the bank. Evidence includes: lack of vegetation cover, fresh new appearance to the soil surface; eroded material accumulated on the lower bank/toe area.

<u>Rilling + gullying</u> occurs when there is sufficient uncontrolled surface run-off over the bank to initialize channelized erosion. Evidence includes: a corrugated appearance to the bank surface due to closely spaced rills; larger gullied

channels incised into the bank face, headward erosion of small tributary gullies into the flood plain surface.

<u>Wind wave</u> erosion is only likely on large rivers with long fetches to allow the build up of significant waves. Evidence includes: large channel width or long, straight channel and acute angle between eroding bank and longstream direction; wave-cut notch at about normal low water plane; wave-cut platform or berm below normal low-water plane. <u>Note</u> that it is easy to mistake the notch and platform produced by piping and sapping for one cut by wave action (see papers by Hagerty and Hagerty, 1989 and by May, 1982).

Vessel Forces can generate bank erosion in a number of The most obvious way is through the generation of surface waves at the bow and stern which run up against the bank in the same fashion as wind waves. In the case of large vessels and/or high speeds these waves may be very damaging. If the size of the vessel is large compared to the dimensions of the channel, then hydrodynamic effects produce surges and drawdown in the flow. These rapid changes in water level too can loosen and erode material on the banks. If the vessels are relatively close to the bank prop. wash can erode material and re-suspend sediments on the bank below the water surface. Finally, mooring vessels along the bank may involve mechanical damage by the hull. Evidence includes: use of river for navigation; large vessels moving close to the bank, high speeds, observation of significant vessel induced waves and surges; a wave-cut notch at the normal low-water plane; a wave-cut platform or berm below normal low-water plane. Note that it is easy to mistake the notch and platform produced by piping and sapping for one cut by vessel forces (see papers by Hagerty and Hagerty, 1989 and by May, 1982).

<u>Ice rafting</u> erodes the banks through mechanical damage to the banks due to the impact of ice-masses floating in the river and due to surcharging by ice cantilevers during spring thaw. Evidence includes: severe winters with river prone to icing over; gouges and disruption to the bank line; topping and cantilever failures of bank during spring break-up.

<u>Aeolian</u> erosion is caused by the wind entraining grains from the bank face or slip-off slope. It will only be significant where vegetation cover is sparce or absent due to the action of other more virulent erosion processes such as flow entrainment or piping. Evidence includes: bare soil surfaces and fine, granular materials; dust and sand blowing around; sediment deposits in areas sheltered from the wind.

Other erosion processes could potentially be significant but it is impossible to list them all individually. If some other

erosive process is identified, tick this box and write it in below the box.

Distribution of Each Process on the Bank recognizes that different processes may be responsible for eroding different parts of the bank. The distribution of up to four different processes over the bank may be delineated here. This is significant because the distribution of different erosion processes has geomorphic implications and may require special consideration when stabilizing the bank.

Part 11: Left Bank Failure Mechanics

This part has 10 topics. The aim is to develop a good understanding of the modes of failure involved in bank retreat and their distribution over the bank, both along the channel and up and down the bank profile.

Status establishes state of stability with regard to mass failure.

Severity puts any instability into perspective. Nearly all rivers have some bank instability, but by no means all merit analysis or treatment.

Extent locates the instability over the bank profile. Generally, whole bank and lower bank failures are most serious to overall bank retreat potential.

Frequency gauges the number of failures observed along the study reach.

Location establishes the position of the failure(s) in relation to major channel features. These may, or may not, be the cause of the problem.

Failure Mode attempts to identify the type of failures resulting from bank instability. This is not an easy task and often requires some training. It is assumed here that the individuals undertaking the survey are somewhat familiar with failure mechanics and recognition of the geometry of the bank which results from different mechanisms. Some guidance is necessary though:

Shallow slide is a shallow seated failure along a plane somewhat parallel to the ground surface. Such failures are common on banks of low cohesion. Shallow slides often occur as secondary failures following rotational slips and/or slab failures. Evidence includes: weakly cohesive bank materials; thin slide layers relative to their area; planar failure surface; no rotation or toppling of failure mass.

<u>Rotational slip</u> is the mass failure mode most commonly dealt with in geotechnical engineering. A deep seated failure along a curved surface results in back-tilting of the failed mass toward the bank. Such failures are common in cohesive banks

with angle below about 60°. Evidence includes: cohesive bank materials; deep seated, curved failure surface; back-tilting of top of failure mass towards intact bank; arcuate shape to intact bank line behind failure mass.

<u>Slab-type</u> failure is the forward toppling of a deep seated mass into the channel. Often there are deep tension cracks in the bank behind the failure block. Slab failures occur in cohesive banks with steep bank angles, greater than about 60°. Evidence includes: cohesive bank materials; deep seated failure surface with a planar lower slope and near vertical upper slope; tension cracks behind the bankline; forward tilting of failure mass into channel; planar shape to intact bankline behind failure mass.

<u>Pop-out failure</u> results from strong seepage in a steep, cohesive bank. A slab of material in the lower half of the steep bank face pops out, leaving an alcove shaped cavity. The overhanging roof of the alcove subsequently collapses as a cantilever type failure. Evidence includes: cohesive bank materials; steep bank face with seep area low in the bank; alcove shaped cavities in bank face.

<u>Cantilever failure</u> is the collapse of an overhanging block into the channel. Such failures occur in composite and layered banks where a strongly cohesive layer is underlain by a less resistant one. Under-mining by flow erosion, piping, wave action or pop-out failure leaves an overhang which collapses by a beam, shear or tensile failure. Evidence includes: composite or layered bank stratigraphy; cohesive layer underlain by less resistant layer; under-mining; overhanging bank blocks; failed blocks on the lower bank and at the bank toe.

Piping failure is the collapse of part of the bank due to high groundwater seepage pressures and rates of flow. Such failures are an extension of the piping process described earlier to the point that there is loss of strength in the seepage layer. Sections of bank disintegrate, are entrained by the seepage flow (termed sapping) and may be transported away from the bank face by surface run-off generated by the seepage, if their is sufficient volume of flow. Evidence includes: pronounced seep lines, especially along sand layers or lenses in the bank; pipe shaped cavities in the bank, notches in the bank associated with seepage zones, run-out deposits of eroded material on the lower bank or berm. Note that the effects of piping failure can easily be mistaken for those of wave and vessel force erosion.

<u>Flow failure</u> is the loss of strength of a section of bank due to saturation. Such failures occur when water logging of the bank increases its weight and decreases its strength to the point that the soil flows as a highly viscous liquid. This may

occur following heavy and prolonged precipitation, snow melt or rapid drawdown in the channel. Evidence includes: sections of bank which have sloughed at very low angles; areas of formerly flowing soil that have been preserved when he soil dried out; basal accumulations of soil showing delta-like patterns and structures.

Ravelling describes the flow-type failure of a dry, granular bank material. Other terms are soil fall and soil avalanche. Such failures occur when a noncohesive bank at close to the angle of repose is undercut, increasing the local bank angle above the friction angle. A carpet of grains rolls, slides and bounces down the bank in a layer up to a few grains thick. Evidence includes: noncohesive bank materials; bank angle close to the angle of repose; undercutting, basal accumulations of loose grains in cones and fans.

Distribution of Each Mode on the Bank recognizes that different failure modes may be involved in the collapse of different parts of the bank. The distribution of up to four different modes over the bank may be delineated here. This is significant because the distribution of different failure modes has geomorphic implications and may require special consideration when stabilizing the bank.

Part 12: Left Bank Berm Characteristics

The part has 13 topics. The aims are to characterize the balance between sediment supply and removal at the bank toe and to establish the degree of berm development there. The sediment balance defines the state of basal endpoint control of the bank. Banks which have net toe erosion are certain to become less stable and to retreat more rapidly in the future unless a more resistant bank material is encountered or steps are taken to stabilize the bank. When stabilizing such banks, special steps must be taken to eliminate continued toe erosion.

Banks which have neither net toe erosion or deposition will continue to retreat at about a constant rate. Only the usual degree of toe scour protection is needed on such banks.

Banks with net toe deposition should show increased stability and a reduced rate of retreat, all else being equal. This is achieved through berm building - the accumulation of a low angle sediment wedge at the bank toe. Hence the degree of berm development is a good indicator of the tendency of the bank towards stability. Given the opportunity, vegetation invades stable berms quite quickly. Therefore, berm vegetation can be used as a guide to the age and permanence of a berm.

Banks with developing, permanent berms should not normally require structural bank protection.

Status establishes the presence or absence of a berm at the bank toe.

Berm Location describes whether a berm is found all along the bank or only inside bends. Often, local erosion at the outer bank in bendways destroys berms in those locations.

Berm Material Size Data records the size distribution of a representative sample of berm sediment.

Berm Materials describes the composition of the berm in terms of the characteristic materials that make up the berm. This supplies vital information on the nature of the berm materials for interpreting berm processes.

Berm Vegetation at the broad scale classifies the types of flora found on the berm.

Age can be a useful guide to the history of the berm. Old and mature vegetation clearly can only develop on a stable berm, while a predominance of young, immature vegetation hints at a recently deposited berm that may be a temporary feature, being destroyed at high flow.

Berm Tree Types recognizes that particular species of tree are more or less effective in stabilizing the berm, while others often cause instability and obstruct the flow.

Density describes the degree of vegetative cover over the berm. The higher the density, the better the vegetative protection and the greater the trap efficiency of the vegetation in inducing further berm deposition, but also the greater the retardance of high in-bank flows.

Diversity deals with the mix of vegetative types present. A more mature ecosystem has increased diversity indicating that there has been a long period of berm stability.

Health identifies the state of the berm vegetation. Dead or dying vegetation quickly becomes a serious liability to berm and channel stability.

Height is a factor in determining the effect of vegetation in impeding near bank flow in the channel and promoting berm sedimentation.

Roots defines the relationship between the vegetation roots and the berm surface. If the elevation of the berm surface has not changed substantially, then the roots are found just below the surface. If the berm is growing, vegetation produces Adventitious roots into the new sediment as this moves the ground surface up relative to the plant. If the berm is eroding, plant roots are exposed as the ground surface moves down relative to the plant. Hence the state of the roots can be used to infer the present trend in berm growth or erosion.

4.2.4 Section 3- Right Bank Survey

Section 3 repeats the bank survey for the other river bank. The section consists of parts 13 to 17 which are indentical to parts 8 to 12 in section 2.

3. CONCLUSION

The sedimentation analysis sheets presented here are a first attempt to develop a system to observe and record information pertaining to sediment impacts and problems on natural water courses. They are to be tested and modified in the light of experience. Any individual who uses the sheets should bear in mind their preliminary nature. Any experience with the sheets would be of interest to the developers, who would be grateful for feedback and comments. Please address any correspondence to either of the investigator named on the front cover of this document or the relevant staff at WES.

5.5 REFERENCES

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APPENDIX B

Recommended Contents for a Field Equipment Backpack

Field Equipment Backpack

Equipment	Primary Usage	<u>Cost (\$)</u>
Backpack Sunta Compass (motal)	Transporting equipment and protecting it from the weather and accidental damage	27.50
Sunto Compass (metal)	Finding direction, orientating maps and aerial photographs, taking bearings, establishing baselines	s. 61.00
Sunto Clinometer	Measuring valley side and bank slopes. Measuring bank and tree heights	187.75
Range-finder	Measuring distances such as channel width and longstream reach length, where access is difficult.	66.75
Lietz Open Reel Tape	Measuring distances such as channel width and longstream reach length, where access is easy.	24.50
Lietz 5x Mag. Hand Level	Leveling cross-sections, bank profiles and long-stream bed and water slopes.	99.00
Lietz Level Rod	Leveling cross-sections, bank profiles and long-stream bed and water slopes.	122.50
Chaining Pins	Marking sections and points of interest.	33.70
Sunglo Vinyl Flagging	Flagging features of interest.	3.00
Stop Watch	Timing transit time of floats for velocity measurement.	not known
Hammer/Hatchet	Clearing brush, hammering pegs.	31.50
Army Trenching Shovel	Digging sample pits and trenches.	5.00
Soil sample Bags (100)	Holding bed, bar and bank material samples.	11.95
Marker Pen	Labeling sediment samples.	1.00
Sieve Screen Set (6 sieves)	On-site sieve analysis of sediment samples	54.50

TOTAL COST OF FIELD BACKPACK (EXCLUDING STOPWATCH) \$729.65

NOTE. All field groups should also be equipped with a first aid kit, insect repellent, sun screen and clothing and footwear appropriate to the field area and weather.

APPENDIX C Completed Sedimentation Assessment Sheets for Clear Creek, Bovina, Mississippi

SEDIMENTATION ANALYSIS SHEET
Developed by Colin R. Thome
for the US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

RIVER CLEAR	CREEK	SITE	BOVINA	REA	From CH FARRAH &	TO IR. TIFTONTOWNBR
SHEET COMPLETED BY	GROUPS 4,5,	6 DATE	0/18/90	TIME: START	2:15 pm	TIME: FINISH 4:40p
	- Cricony	OR 1 WALLEY A	vo culturer	CUDYEV		
PART I: AREA ARO		ON 1 - VALLEY A	NU CHANNEL	SURVEY		
Terrain Mountains Uplands Hills Plains Lowlands	Geology Bed rock Moraine Glacio/Fluvial Fluvial Lacustrine (ind blown (losss)	Rock Type Cemented Clay Shale Limestone Sandstone Conglomerate Granite No Rock	Cultiv	Use attral X vated X vrban	Vegetation None Grass Arable Crops Shrubs Forest	Forest Type None Deciduous Coniferous Mixed
PART 2: VALLEY SI Height < 20 feet 20.50 feet X 50.100 feet >100 feet	Side Slope Angle < 30 degrees 30-60 degrees >60 degrees	Valley side Fallures None X Occasional Frequent	Mod	lems icant 🔀	ilure Locations None Away from river ng river (Undercut)	
Adjusted Incised	Stability:extent None Local General Reach scale System wide Regional scale Number	Terraces None X Indefinate Fragmentary Continuous Number of terraces above valley Floor	Overbank E Fine Medium Coarse	None X Silt sand sand	Levees None Indefinate Fragmentary Continuous Levee Type Natural Man-made (Road)	Levee Fallures None X Occasional
PART 4: LATERAL R Present Status I Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious	ISTATION OF CHA: ISTABILITY: extent None Local General X Reach scale System wide Regional scale	Planform Straight Sinuous Irregular Regular meanders X Irregular meanders Tortuous meanders Braided	Ptanform Bend R Meander belt Wavel Meander Sinu	adius 200- width 500- ength 600	Fragmentary Continuous	Valley Floor Data 1 nver width 1 - 5 river widths > 5 nver widths Note: Note: width = channel top width
DART & CHANNE	DECCRIPTION:					
Ave. water width Ave. water depth Reach slope	Flow Type Flow Type Flow None Uniform/Tranquil Flow Type Flow Type Flow Type Flow None Flow Type Flow None Flow Type Flow Type Flow None Flow Type	Bed Controls None Occasional Frequent Confined Number of controls	J Be	None drock drock diders prons drock	Width Controls None Occasional Frequent Confined Number of controls Rip Rap	Control Types None Bedrock Boulders Gravel armor Revetments Bridge abutmenta X dykes or groynes
PART 7: BED SEDIM	ENT DESCRIPTION		Bed F	OFMS_		
Bed Material Silt X Sand X Sand and gravel X gravel and cobbles cobbles + boulders boulders + bedrock Bed rock S	Bed Armour Nune Static-armour Mobile-armour S Sediment Depth Depth of loose diment in bed (ft)	Surface Size Dat D50 (mm) D84 (mm) Sorting coefficient ubstrate Size Dat D50 (mm) D84 (mm) Sorting coefficient	Ri I Bed form heigi Island or Occas	Bars None ional X	Bar Types None Pools and riffles Alternate bars Point bars Mid-channel bars Diagonal bars Sand waves + dunes	D84 (mm)

Subreach & 1 SECTION 2. LEFT BANK SURVEY

	NK CHARACTERIST	CICS			
Type	Bank Materials M		Layer Thickness	Tension Cracks (rack Extent
Noncohesive X	Silt/clay	Average beight (ft)	Material 1 (ft) 2	None X	Proportion of
		WACISSE DEIBIT (IT)[11]			
Cohesive	Sand/silt/clay	'	Material 2 (ft) 9	Occasional	bank height 🔲
Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	
Layered	Sand X	2. Average angle (o) 25	35/k Material 4 (ft)		}
Even Layers	Sand/gravel				
Thick+thin layers	Gravel	Distribution	and Description of	Bank Materials in Bank	Profile
Number of layers 2	Gravel/cobbles		Material Type 2		laterial Type 4
Number of Tayers	Cobbles	ToeX	Toe	Tœ□	Toe
[· -		
Protection Status	Cobbles/boulders	Mid-Bnak 🗡	Mid-Bnak 🔀	Mid-Bnak	Mid-Bnak
Unprotected X	Boulders/bedrock	Upper Bank	Upper Bank ¥	Upper Bank	Upper Bank
Hard points		Whole Bank	Whole Bank	Whole Bank	Whole Bank
Reverments		D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
Dyke Fields		sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
Dyke Fields [wang wemacan	solung continuent	solding coefficient	
L					
	NK-FACE VEGETAT				
Vegetation	Tree Types	Density	Location	Health	Height (
None	None	None	Whole bank X	Healthy X	Short X
Cleared	Alder	Sparce	Bank top	Fair	Medium
Grass and flora	Ash	Medium	Mid-bank	Poor	Tall
, —				-	ا السن
Reeds and sedges	Beech	Dense 🔀	Trees Bank toe	Dead	ſ
Shrubs ¥	Birch				
Saplings x	Cottonwood 🗌	Spacing	Diversity	Age	Extent
Trees X	Elm	Continuous	Mono-stand	Imanure	- Wide □
1	Sweet gum	—	Tree Mixed	Mature	Medium
1				p-al	
I	Willow	Wide [Climax-vegetation	OM	Narrow
L					
PART 10: LEFT BA	ANK EROSION PRO	CESSES			
Status	Extent	Location	Processes	Distribution of Each	Process on Bank
Intact	Toe 🗍	General 🔀	Flow entrainment	Process 1	Process 2
Eroding	Lower bank X	Outside Meander	Piping	Toe	Tœ□
	P-4				
Advancing X	Upper bank	Inside Meander	Freeze/thaw	Lower bank	Lower bank
	Whole bank	Opposite a bar	Sheet erosion	Upper bank	Upper bank
Severity	Estimated rate	Behind a bar	Rilling + gullying	Whole bank	Whole bank
Insignificant	< 3ft/yr 🗶	Opposite a structure	Wind waves	Process 3	Process 4
Mild	3 - 10 ft/yr	Adjacent to structure	Vessel Forces	Toe□	Tœ□
				·	
Significant	10 - 25 ft/yr	Distream of structure	Ice rafting	Lower bank	Lower bank
Serious	>25 ft/yr	Upstream of structure	Aeolian	Upper bank	Upper bank
Catastrophic		Other	Other	Whole bank	Whole bank
			_	_	_
<u> </u>					
DADT 11. 1 PLT B	NV CALLUDE MEC	MANICS			
PART 11: LEFT BA	ANK FAILURE MEC	HANICS		District of Frank	Made as Deat
(Distribution of Each	
Status	ANK FAILURE MEC	HANICS Location	Failure Mode	Distribution of Each !	Mode on Bank Mode 2
Status			Failure Mode Shallow slide		
Status Stable	Extent Toe	Location General	Shallow slide	Mode 1 Tœ ☐	Mode 2 Toe ☐
Status Stable X Unreliable	Extent Toe Lower bank	Location General Outside Meander	Shallow slide Rotational slip	Mode 1 Toe Lower bank	Mode 2 Toe Lower bank
Status Stable	Extent Toe Lower bank Upper bank	Location General Outside Meander Inside Meander	Shallow slide Rotational slip Slab-type	Mode 1 Toe Lower bank Upper bank	Mode 2 Toe Lower bank Upper bank
Status Stable X Unreliable Unstable	Extent Toe Lower bank Upper bank Whole bank	Location General Outside Meander Inside Meander Opposite a bar	Shallow slide Rotational slip Slab-type Pop-out failure	Mode 1 Toe Lower bank Upper bank Whole bank	Mode 2 Toe Lower bank Upper bank Whole bank
Status Stable X Unreliable Unstable Severity	Extent Toe Lower bank Upper bank Whole bank Frequency	Location General Outside Meander Inside Meander Opposite a bar Behind a bar	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4
Status Stable X Unreliable Unstable	Extent Toe Lower bank Upper bank Whole bank	Location General Outside Meander Inside Meander Opposite a bar	Shallow slide Rotational slip Slab-type Pop-out failure	Mode 1 Toe Lower bank Upper bank Whole bank	Mode 2 Toe Lower bank Upper bank Whole bank
Status Stable X Unreliable Unstable Severity	Extent Toe Lower bank Upper bank Whole bank Frequency	Location General Outside Meander Inside Meander Opposite a bar Behind a bar	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4
Status Stable X Unreliable Unstable Severity Insignificant X Moderate	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank
Status Stable X Unreliable Unstable Severity Insignificant X	Extent Toc Lower bank Upper bank Whole bank Frequency None	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank
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Status Stable X Unreliable Unstable Severity Insignificant X Moderate Serious	Extent Toe Lower bank Upper bank Whole bank Frequency None Ocasional Frequent	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Lower bank Upper bank Upper bank Upper bank
Status Stable X Unreliable Unstable Severity Insignificant X Moderate Serious	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank
Status Stable X Unreliable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B. Present Status	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank
Status Stable X Unreliable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank None	Mode 2 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Whole bank
Status Stable X Unreliable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Salt/clay Sand/silt/clay	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Unstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank Whole bank Whole bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Unhealthy Unhealthy
Status Stable X Unreliable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm X	Extent Toe Lower bank Upper bank Whole bank Frequency None Ocasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt.	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Unstream of structure Upstream of structure Upstream Vegetation None Cleared Grass and flora	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank Whole bank Whole bank	Mode 2 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Whole bank
Status Stable X Unreliable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm X large berm	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Sill/clay Sand/silt/clay Sand/silt/Sand	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berim Vegetation None Cteared Grass and flora Reeds and sedges	Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Opper bank Whole bank Whole bank Whole bank Whole bank Whole bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Dead
Status Stable X Unreliable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm X	Extent Toe Lower bank Upper bank Whole bank Frequency None Ocasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt.	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Unstream of structure Upstream of structure Upstream Vegetation None Cleared Grass and flora	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank Whole bank Whole bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Unhealthy Unhealthy
Status Stable X Unreliable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm large berm Berm Location	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/gravel Sand/gravel	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dustream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs X	Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Opper bank Whole bank Whole bank Whole bank Whole bank Whole bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Dead
Status Stable X Unreliable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm Large berm Berm Location None	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/gravel Gravel	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Unstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora X Reeds and sedges Shrubs X Saplings X	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm	Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Whole bank Whole bank Denseity None Sparce Medium Dense Diversity Mono-stand	Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Whole bank Health Health Health Shon
Status Stable X Unreliable Unstable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm dium berm Large berm Berm Location None Only inside bends X	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Gravel/Cobbies	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dustream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs X	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Health Health Healthy Dead Height Short Medium ###################################
Status Stable X Unreliable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm Marge berm Berm Location None Only inside bends X Continuous	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Caravel Gravel Gravel Gravel Cobbles Cobbles	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cteared Grass and flora Reeds and sedges Shrubs Saplings Trees	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Upper bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Healthy Dead Height Short Medaum Tall
Status Stable X Unreliable Unstable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm X large berm Berm Location None Only inside bends X Continuous Berm Material	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/gravel Gravel/cobbles Cobbles Cobbles/boulders	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Unstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora X Reeds and sedges Shrubs X Saplings X	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum Willow	Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Denset Modeum Denset Modeum Denset Modeum Denset Mixed Climax-vegetation Spaciag	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Health Health Healthy Dead Height Short Middium Tall Roots
Status Stable X Unreliable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm Marge berm Berm Location None Only inside bends X Continuous	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Caravel Gravel Gravel Gravel Cobbles Cobbles	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cteared Grass and flora Reeds and sedges Shrubs Saplings Trees	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Upper bank	Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Healthy Dead Height Short Medaum Tall
Status Stable X Unreliable Unstable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm X large berm Berm Location None Only inside bends X Continuous Berm Material Size Data	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt Sand/gravel Gravel/cobbles Cobbles/boulders Boulders	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora X Reeds and sedges Shrubs Saplings Trees Age Imature	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum Willow	Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Upper bank Upper bank Whole bank Whole bank Climasetty Mono-stand Mixed Climax-vegetation Spacing Continuous	Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Whole bank Health Health Healthy Dead Height Short Moduum I Tall Roots Normal
Status Stable X Unreliable Unstable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm dium berm Location None Only inside bends Continuous Berm Material Size Data D50 (mm)	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/gravel Gravel/cobbles Cobbles Cobbles/boulders	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Instream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs X Saplings X Trees Age Imature Mature X	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum Willow	Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Dense Sparce Medium Dense Diversity Mono-stand Mixed Climax-vegetation Spaclag Continuous Close K	Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Health Health Health Health Roots Normal Advantitious
Status Stable X Unreliable Unstable Unstable Unstable Severity Insignificant X Moderate Serious PART 12: LEFT B Present Status No berm cmall berm medium berm X large berm Berm Location None Only inside bends X Continuous Berm Material Size Data	Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt Sand/gravel Gravel/cobbles Cobbles/boulders Boulders	Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora X Reeds and sedges Shrubs Saplings Trees Age Imature	Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum Willow	Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Upper bank Upper bank Whole bank Whole bank Climasetty Mono-stand Mixed Climax-vegetation Spacing Continuous	Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Whole bank Health Health Healthy Dead Height Short Moduum I Tall Roots Normal

SubReach 3

	K CHARACTERIST	ICS	BANK SUKVET		
Туре	Bank Materials M		Layer Thickness	Tension Cracks	Crack Extent
Noncohesive X	Silt/clay	Average height (ft) /5		None	Proportion of
Cohesive	Sand/silt/clay		Material 2 (ft)	Occasional	bank height
Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	
Layered	Sand X	Average angle (o)	Material 4 (ft)	11040000]
Even Layers X	Sand/gravel	Arterage unique (O)	35 MALCHE + (II)		
Thick+thin layers	Gravel	Diet-thutto	a and Description of	Bank Materials in Ban	L Buckle
Number of layers 3	Gravel/cobbles	Material Type 1	Material Type 2		Material Type 4
Manoer or myers[3]	Cobbles	Toel		• • • • • • • • • • • • • • • • • • • •	
D			Toe	Toe	Toe
Protection Status	Cobbles/boulders	Mid-Bnak	Mid-Bnak	Mid-Bnak	Mid-Bnak
Unprotected X	Boulders/bedrock	Upper Bank	Upper Bank	Upper Bank	Upper Bank
Hard points		Whole Bank	Whole Bank	Whole Bank	Whole Bank
Revetments		D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
Dyke Fields		sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
	NK-FACE VEGETAT	TION			
Vegetation	Tree Types	Density	Location	Health	Height
None	None []	None	Whole bank X	Healthy X	Short
Cleared	Alder	Sparce	Bank top	Fair	Medium X
Grass and flora	Ash 🗀	Medium	Mid-bank	Poor	Tall
Reeds and sedges	Beech	Dense X	Bank toe	Dead	ا ك
Shrubs X	Birch				
Saplings	Cottonwood	Spacing	Diversity	Age	Extent
Trees X	Elm	Continuous	Mono-stand	Imature	Wide[7]
11000[]	—	———			
	Sweet gum	Close	Mixed	Mature X	Medium
	Willow	Wide	Climax-vegetation X	OM[]	Narrow 🔲
L					
PART 10: LEFT BA	NY EDOCION BOO	CECCEC			
PAKT IU: LEFT BA Status			n	District A P :	<u> </u>
	Extent	Location	Processes	Distribution of Each	
Intact	Toe 💢 Lower bank 🔀	General X	Flow entrainment	Process 1	Process 2
Eroding		Outside Meander	Piping	Toe 🔝	Toe 📋
Advancing X	Upper bank	Inside Meander	Freeze/thaw	Lower bank	Lower bank
_	Whole bank	Opposite a bar	Sheet erosion	Upper bank	Upper bank
Severity	Estimated rate	Behind a bar	Rilling + gullying	Whole bank	Whole bank
Insignificant	< 3ft/yr 💢	Opposite a structure	Wind waves	Process 3	Process 4
Mild X	3 - 10 ft/yr	Adjacent to structure	Vessel Forces	Tœ□	Toe 🗍
Significant				· · · · — ·	
Significant	10 - 25 ft/yr	Dostream of structure	Ice rafting	Lower bank	Lower bank
Serious	10 - 25 ft/yr	Distream of structure Upstream of structure	Ice rafting Acolian	Lower bank Upper bank	Lower bank Upper bank
	10 - 25 ft/yr	Dostream of structure	Ice rafting	Lower bank	Lower bank
Serious	10 - 25 ft/yr	Distream of structure Upstream of structure	Ice rafting Acolian	Lower bank Upper bank	Lower bank Upper bank
Serious Catastrophic	10 · 25 ft/yr >25 ft/yr	Distream of structure Upstream of structure Other	Ice rafting Acolian	Lower bank Upper bank	Lower bank Upper bank
Serious	10 · 25 ft/yr >25 ft/yr	Distream of structure Upstream of structure Other	Ice rafting Acolian	Lower bank Upper bank Whole bank	Lower bank Upper bank Whole bank
Serious Catastrophic PART 11: LEFT BA	10 · 25 ft/yr >25 ft/yr	Dnstream of structure Upstream of structure Other	Ice rafting Acolian Other	Lower bank Upper bank Whole bank Distribution of Each	Lower bank Upper bank Whole bank Mode on Bank
Serious Catastrophic PART 11: LEFT BA	10 · 25 ft/yr >25 ft/yr	Dostream of structure Upstream of structure Other HANICS Location	Ice rafting Acolian Other	Lower bank Upper bank Whole bank Distribution of Each Mode I	Lower bank Upper bank Whole bank Mode on Bank Mode 2
Serious Catastrophic PART 11: LEFT BA Status Stable	10 · 25 fuyr >25 fuyr NK FAILURE MEC Extent Toe	Dostream of structure Upstream of structure Other HANICS Location General	Ice rafting Acolian Other Failure Mode Shallow slide	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe	Lower bank Upper bank Whole bank Mode on Bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable	10 · 25 fu/yr >25 fu/yr NK FAILURE MEC Extent Toe	Dostream of structure Upstream of structure Other HANICS Location General Outside Meander	Ice rafting Acolian Other	Lower bank Upper bank Whole bank Distribution of Each Mode I	Lower bank Upper bank Whole bank Mode on Bank Mode 2
Serious Catastrophic PART 11: LEFT BA Status Stable	10 · 25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Upper bank	Dostream of structure Upstream of structure Other HANICS Location General	Ice rafting Acolian Other Failure Mode Shallow slide	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe	Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable	10 · 25 fu/yr >25 fu/yr NK FAILURE MEC Extent Toe	Dostream of structure Upstream of structure Other HANICS Location General Outside Meander	Ice rafting Acolian Other Failure Mode Shallow slide Rotational slip	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe Lower bank	Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable	10 · 25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Upper bank	Dostream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander	Failure Mode Shallow slide Rotational slip Slab-type	Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank	Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank	Dostream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure	Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Whole bank Mode 3	Mode on Bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Opposite structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Mode 3 Toe	Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant Moderate	10 · 25 ft/yr >25 ft/yr >25 ft/yr	Dnstream of structure Upstream of structure Other Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank	Mode on Bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Toe Lower bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping	Distribution of Each Mode I Toe Lower bank Whole bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Upper bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant Moderate	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Dnstream of structure Upstream of structure Other Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank	Mode on Bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Toe Lower bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant Moderate	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Distribution of Each Mode I Toe Lower bank Whole bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Upper bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant Moderate	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Distribution of Each Mode I Toe Lower bank Whole bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Upper bank
Serious Catastrophic PART II: LEFT BA Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacens structure Upstream of structure Upstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling	Distribution of Each Mode 1 Toe Lower bank Whole bank Whole bank Upper bank Whole bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank	Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank
Serious Catastrophic PART 11: LEFT BA Status Stable Vareliable Unreliable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent NK BERM CHARA Berm Materials	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types	Distribution of Each Mode I Toe Lower bank Whole bank Whole bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Whole bank	Mode on Bank Whole bank Mode 2 Toe Lower bank Whole bank Whole bank Whole bank Whole bank Whole bank Health
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent NK BERM CHARA Berm Materials Silt/clay	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank	Mode on Bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Whole bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent NK BERM CHARA Berm Materiais Sull/clay Sand/silt/clay	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder	Distribution of Each Mode 1 Toe Lower bank Whole bank Whole bank Upper bank Whole bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Node 3 Toe Lower bank Upper bank Whole bank Whole bank	Mode on Bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Lower bank Whole bank Whole bank Health Health Health
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent NK BERM CHARA Berm Materials Sült/clay Sand/sült/clay Sand/sült	Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacens structure Distream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ath	Distribution of Each Mode I Toe Lower bank Whole bank Whole bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank	Mode on Bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Whole bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm large berm	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent NK BERM CHARA Berm Materials Sill/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay	Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank	Mode on Bank Whole bank Mode 2 Toe Lower bank Whole bank Whole bank Whole bank Whole bank Whole bank Health Health Health Dead
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm large berm Berm Location	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent NK BERM CHARA Berm Materiass Siluclay Sand/silt/clay Sand/silty Sand/silty Sand/gravel	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite a structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Whole bank Dense Diversity	Mode on Bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Upper bank Health Health Health Health Health Health
PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm large berm Berm Location None	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sill/clay Sand/sill/clay Sand/sill Sand Sand/gravel Gravel	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Revelling Berm Tree Types None Alder Ash Birch Cottonwood Elm	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank	Mode on Bank Whole bank Mode 2 Toe Lower bank Whole bank Whole bank Whole bank Whole bank Whole bank Health Health Health Dead
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm large berm Berm Location	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent NK BERM CHARA Berm Materiass Siluclay Sand/silt/clay Sand/silty Sand/silty Sand/gravel	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite a structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Whole bank Dense Diversity	Mode on Bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Upper bank Health Health Health Health Health Health
PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm large berm Berm Location None	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sill/clay Sand/sill/clay Sand/sill Sand Sand/gravel Gravel	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Revelling Berm Tree Types None Alder Ash Birch Cottonwood Elm	Distribution of Each Mode I Toe Lower bank Whole bank Whole bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank Whole bank Whole bank Density None Sparce Medium Dense Diversity Mono-stand Mixed	Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Health Health Health Health Health Short
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm large berm Berm Location None Only inside bends	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent NK BERM CHARA Berm Materials Sül/clay Sand/sil/clay Sand/sil/clay Sand/sil/clay Gravel Gravel	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite at structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Casard Grass and flora Reeds and sedges Shrubs Saplings Trees	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum	Distribution of Each Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank U	Mode on Bank Whole bank Whole bank Mode 2 Toe Lower bank Whole bank Whole bank Whole bank Whole bank Whole bank Health Health Health Health Health Health Health Mode Toe Lower bank Upper bank Upper bank Whole bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm large berm Berm Location None Only inside berds Continuous Berm Material	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sill/clay Sand/silt/clay Sand/silt/clay Sand/gravel Gravel/cobbles Cobbles/Coulders	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shruba Saplings Trees Age	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Flow failure Ra	Lower bank Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Whole bank Upper bank	Lower bank Whole bank Whole bank Mode 2 Toe Lower bank Whole bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Tae Lower bank Upper bank Upper bank Upper bank Tae Lower bank Upper bank Tae Lower bank Upper bank
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm large berm Berm Location None Only inside bends Continuous Berm Material Size Data	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Core Core Core Core Core Core Core Core	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees Age Imature	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum	Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Whole bank Density None Sparce Medium Dense Diversity Mono-stand Mixed Climax-vegetation Spacing Continuous	Mode on Bank Whole bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Toe Lower bank Upper bank Whole bank Tall Roots Normal
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm semall berm medium berm large berm Berm Location None Only inside bends Continuous Berm Material Size Data D50 (mm)	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sill/clay Sand/silt/clay Sand/silt/clay Sand/gravel Gravel/cobbles Cobbles/Coulders	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees Age Imsture Mature	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Flow failure Ra	Distribution of Each Mode 1 Toe Lower bank Whole bank Upper bank Whole bank Upper bank Whole bank Clower bank Upper bank Whole bank Clower bank Whole bank Clower bank Cl	Mode on Bank Whole bank Health Health Health Health Health Roots Normal Advantitious
Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status No berm small berm medium berm large berm Berm Location None Only inside bends Continuous Berm Material Size Data	NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Core Core Core Core Core Core Core Core	Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees Age Imature	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Flow failure Ra	Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Whole bank Density None Sparce Medium Dense Diversity Mono-stand Mixed Climax-vegetation Spacing Continuous	Mode on Bank Whole bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Whole bank Normal Roots Normal

Jub-reach 2

	CIL OU A DA CEPCO ICT	SECTION 2 - LEFT	BANK SURVEY		
	K CHARACTERIST				
Type	Bank Materiais Me		Layer Thickness		Crack Extent
Noncohesive	Silt/clay 🔀	Average height (ft) 15	Material 1 (ft)	None	Proportion of
Cohesive X	Sand/silt/clay	,—	Material 2 (ft)	Occasional X	bank height 10%
Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	
Layered	Send	Average angle (o) 75	Material 4 (ft)		ì
Even Layers	Sand/gravel		۵,		
Thick+thin layers	Gravel	Distribution	and Description of	Bank Materials in Bani	k Profile
	Gravel/cobbles		Material Type 2		
Number of layers		Material Type 1			daterial Type 4
1	Cobbles	Toe	Toe	Toe	Toe
Protection Status	Cobbles/boulders	Mid-Bnak	Mid-Bnak	Mid-Bnak 🔠	Mid-Bnak
Unprotected X	Boulders/bedrock	Upper Bank	Upper Bank	Upper Bank	Upper Bank
Hard points	_	Whole Bank	Whole Bank	Whole Bank	Whole Bank
Reverments		D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
			sorting coefficient		
Dyke Fields [sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
p					
PART 9: LEFT BA	NK-FACE VEGETAT	TION			,
Vegetation	Tree Types	Density	Location	Health	Height
None	Name X	None	Whole bank	Healthy	Short
Cleared	Alder	Sparce X	Bank top	Fair	Medium
Grass and flora	_ Ash	Medium	Mid-bank	Poor	Tall 🔲
Reeds and sedges	Beech	Dense	Bank toc X	Dead	
Shrubs	Birch		_	_	
Saplings	Cottonwood	Spacing	Diversity	Age	Extent
Trees	Elm	Continuous	Mono-stand	Imature	Wide
Index	_			—	
Ì	Sweet gum	Close	Mixed	Mature	Medium
ľ	Willow	Wide X	Climax-vegetation	OM	Narrow
PART 10: LEFT BA	NK EROSION PRO	CESSES			
Status	Extent	Location	Processes	Distribution of Each	Process on Bank
Intact	Toe □	General	Flow entrainment	Process 1	Process 2
	Lower bank				
Eroding X		Outside Meander X	Piping	Tœ	Toe
Advancing	Upper bank	Inside Meander	Freeze/thaw	Lower bank	Lower bank
i	Whole bank X	Opposite a bar X	Sheet erosion	Upper bank	Upper bank
I 6					
i Severity	P.SIIMALEG PALE	Hehind a harf	Rilling + gullvingl 1	Whole bank	Whole hank!!!
Severity	Estimated rate	Behind a bar	Rilling + gullying	Whole bank	Whole bank
Insignificant	< 3ft/yr□	Opposite a structure	Wind waves	Process 3	Process 4
Insignificant Mild	< 3ft/yr 3 - 10 ft/yr X	Opposite a structure Adjacent to structure	Wind waves	Process 3	Process 4
Insignificant	< 3ft/yr ☐ 3 - 10 ft/yr 🗶	Opposite a structure	Wind waves	Process 3	Process 4
Insignificant Mild Significant X	< 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr	Opposite a structure Adjacent to structure Donstream of structure	Wind waves Vessel Forces Ice rafting	Process 3 Toe Lower bank	Process 4 Toe Lower bank
Insignificant Mild Significant X Serious	< 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr	Opposite a structure Adjacent to structure Dristream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant X	< 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr	Opposite a structure Adjacent to structure Donstream of structure	Wind waves Vessel Forces Ice rafting	Process 3 Toe Lower bank	Process 4 Toe Lower bank
Insignificant Mild Significant X Serious	< 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr	Opposite a structure Adjacent to structure Dristream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant Serious C: astrophic	< 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr >25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant Serious C: astrophic	< 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank Whole bank	Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant X Serious C: astrophic	< 3 ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr > 25 ft/yr X 10 NK FAILURE MEC	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Acolian Other	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each	Process 4 Toe Lower bank Upper bank Whole bank Whole bank
Insignificant Mild Significant Serious C: astrophic	< 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr >25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank Whole bank	Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant X Serious C: astrophic	< 3 ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr > 25 ft/yr X 10 NK FAILURE MEC	Opposite a structure Adjacent to structure Dustream of structure Upstream of structure Other HANICS	Wind waves Vessel Forces Ice rafting Aeolian Other	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each	Process 4 Toe Lower bank Upper bank Whole bank Whole bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable	<pre>< 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr >25 ft/yr >RK FAILURE MEC Extent Toe</pre>	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General	Wind waves Vessel Forces Ice rafting Aeolian Other Fallure Mode Shallow slide	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe	Process 4 Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Toe
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable	3 ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr > 25 ft/yr > 25 ft/yr	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide Rotational slip	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank	Process 4 Toe Lower bank Upper bank Whole bank Whole bank Toe Lower bank Upper bank Toe Lower bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable		Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type I	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank	Process 4 Toe Lower bank Upper bank Whole bank Whole bank Mode 2 Lower bank Upper bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable	3 ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr > 25 ft/yr > 25 ft/yr	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Uther HANICS Location General Outside Meander Inside Meander Opposite a bar	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type I Pop-out failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Whole bank Whole bank	Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 1 Lower bank Mode 2 Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable		Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type I Popout failure Cantilever failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank	Process 4 Toe Lower bank Upper bank Whole bank Whole bank Mode 2 Lower bank Upper bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable	3 ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr > 25 ft/yr > 25 ft/yr	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Uther HANICS Location General Outside Meander Inside Meander Opposite a bar	Wind waves Vessel Forces Ice rafting Aeolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Whole bank Whole bank	Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 1 Lower bank Mode 2 Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant	<pre> < 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr >25 ft/yr >Z5 ft/yr NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank X Frequency None None</pre>	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide Rotational slip Slab-type I Pop-out failure Cantilever failure Piping 2	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe	Mode on Bank Mode on Bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Upper bank Whole bank Whole bank Toe
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Insignificant Moderate	<pre> </pre> <pre> <pre> <pre> <pre> <pre> </pre> <pre> <pre< td=""><td>Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure</td><td>Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type I Pop-out failure Cantilever failure Piping Flow failure Plow failure</td><td>Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Whole bank Whole bank Toe Lower bank Lower bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Lower bank</td><td>Mode on Bank Mode 2 Lower bank Upper bank Whole bank Mode 2 Lower bank Upper bank</td></pre<></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre>	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type I Pop-out failure Cantilever failure Piping Flow failure Plow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Whole bank Whole bank Toe Lower bank Lower bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Lower bank	Mode on Bank Mode 2 Lower bank Upper bank Whole bank Mode 2 Lower bank Upper bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant	<pre> < 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Frequent </pre>	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide Rotational slip Slab-type I Pop-out failure Cantilever failure Piping 2	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank X Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 2 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Mode 4 Lower bank Upper bank Upper bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Insignificant Moderate	<pre> < 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Frequent </pre>	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type I Pop-out failure Cantilever failure Piping Flow failure Plow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Whole bank Whole bank Toe Lower bank Lower bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Lower bank	Mode on Bank Mode 2 Lower bank Upper bank Whole bank Mode 2 Lower bank Upper bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Insignificant Moderate	<pre> < 3ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Frequent </pre>	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type I Pop-out failure Cantilever failure Piping Flow failure Plow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank X Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 2 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Mode 4 Lower bank Upper bank Upper bank
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious	<pre> </pre> <pre> <pre> <pre> <pre> <pre> </pre> <pre> <pre< td=""><td>Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure</td><td>Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type I Pop-out failure Cantilever failure Piping Flow failure Plow failure</td><td>Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank X Mode 3 Toe Lower bank Upper bank Upper bank Upper bank</td><td>Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 2 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Mode 4 Lower bank Upper bank Upper bank</td></pre<></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre>	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Falture Mode Shallow slide Rotational slip Slab-type I Pop-out failure Cantilever failure Piping Flow failure Plow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank X Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Mode on Bank Mode 2 Toe Lower bank Whole bank Mode 2 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Mode 4 Lower bank Upper bank Upper bank
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Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status Somious PART 12: LEFT BA Berm Location None	3 ft/yr 3 - 10 ft/yr X 10 - 25 ft/yr > 25 ft/yr > 25 ft/yr > 25 ft/yr > 26 ft/yr > 27 ft/yr > 28	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubb Saplings	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Density None Sparce Medium Density Mode-stand	Mode on Bank Whole bank Upper bank Whole bank Mode 2 Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Hode 4 Toe Lower bank Upper bank Whole bank Upper bank Whole bank Health Health Health Short
Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Winderstable Unstable Winderstable	Sityr 3 - 10 ftyr X 10 - 25 ftyr > 25 ftyr	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other Location General Outside Meander Opposite a bar X Behind a bar Opposite structure Adjacent structure Dnstream of structure Upstream of structure Upstream of structure Creared Grass and flora Reeds and sedges Shrubs	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type I Popout failure Piping Z Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank	Mode on Bank Whole bank Health Health Health Health Health Height Short Modium
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Insignificant Mild Significant Serious C: astrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unstable Winderstable Unstable Winderstable	Sityr 3 - 10 ftyr X 10 - 25 ftyr > 25 ftyr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubb Saplings	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type I Popout failure Piping Z Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank	Mode on Bank Whole bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Health Healthy Unhealthy Unhealthy Dead Height Short Modium
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Whole Reach

_			SECTION 3 - RIGHT	BANK SURVEY		
		BANK CHARACTER				
	Type	Bank Materials M		ayer Thickness		Crack Extent
1	Noncohesive	Silt/clay	Average height (ft)	Material 1 (ft) 2	None	Proportion of
1	Cohesive	Sand/silt/clay	2 -	Material 2 (ft) 8	Occasional	bank height[_]
	Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	1
	Layered	Sand	Average angle (o) 35	Material 4 (ft)		
	Even Layers	Sand/gravel X	N	and Danminston of	Donk Massalate to Dan	
	Thick+thin layers	Gravel		Material Type 2	Bank Materials in Ban	Asterial Type 4
	Number of layers	Gravel/cobbles Cobbles		Material Type 2	Material Type 3 N Toe□	Toe
	Band-otton Status	Cobbles/boulders	Toe X Mid-Bnak	Mid-Bnak X	Mid-Bnak	Mid-Bnak
	Protection Status	Boulders/bedrock	——————————————————————————————————————	Upper Bank X	Upper Bank	Upper Bank
	Unprotected		Upper Bank	Whole Bank	Whole Bank	Whole Bank
	Hard points	Wood board	Whole Bank	D50 (mm)		D50 (mm)
	Revelments	four last sand	D50 (mm)	· '—	D50 (mm)	` ' L
1	Dyke Fields	bar at bridge	sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
- 1			···			
1	PART 14: RIGHT	BANK-FACE VEGET	ATION			
1	Vegetation	Tree Types	Density	Location	Health	Height
	Nane	None	None 🗍	Whole bank	Healthy	Short
	 (Alder	Sparce	Bank top	FairX	Medium X
	Cleared Grass and flora	Ash	Medium	Mid-bank	Poor	Tall
		Beech	Dense	Bank toe	Dead	·L]
- 1	Reeds and sedges	Birch	Dense	Dank (OE	Desc[
	Shrubs	Cottonwood	Snacino	Diversity	4-4	Extent
- {	Saplings	Eim	Spacing	Mono-stand	Age Imature ◯◯	Wide
Ì	Trees X		Continuous	Mono-stand Mixed X		Medium
		Sweet gum	Close		Mature	
		Willow	Wide	Climax-vegetation	ON	Narrow[X
						
1	PART 15: RIGHT I	BANK EROSION PR	OCESSES			
	Status	Extent	Location	Processes	Distribution of Each	Process on Bank
	Intact	Toe	General	Flow entrainment	Process 1	Process 2
- 1	Eroding	Lower bank	Outside Meander	Piping	Tœ□	Toe 🗍
-	Advancing	Upper bank X	Inside Meander X	Freeze/thaw	Lower bank	Lower bank
	You with the Young	Whole bank	Opposite a bar	Sheet erosion	Upper bank X	Upper bank
	Savarite	Estimated rate	Behind a bar	Rilling + gullying	Whole bank	Whole bank
	Severity	-		Wind waves	Process 3	Process 4
	Insignificant	< 3ft/yr 🗴	Opposite a structure	Vessel Forces	Toe	Toe
	Mild	3 - 10 ft/yr	Adjacent to structure Donstream of structure	lce rafting	Lower bank	Lower bank
	Significant	10 - 25 ft/yr	Upstream of structure	~H	-	Upper bank
- 1	Serious	>25 ft/yr	Other	Aeolian Other	Upper bank Whole bank	Whole bank
	Catastrophic		Oute [Out L	WHOLE OFFICE	WHOLE DALK
	PART 16: RIGHT I	BANK FAILURE ME	CHANICS			
	IARI IO RIGIII I				Distribution of Each	Mode on Bank
	Status	Extent	Location	Failure Mode	Mode 1	Mode 2
	Stable	Toe	General	Shallow slide	Tœ□	Toe 🗀
	Unreliable	Lower bank	Outside Meander	Rotational slip	Lower bank	Lower bank
ᇲ	Unstable	Upper bank	Inside Meander X	Slab-type	Upper bank X	Upper bank
		Whole bank	Opposite a bar	Pop-out failure	Whole bank	Whole bank
7	Severity	Frequency	Behind a bar	Cantilever failure	Mode 3	Mode 4
d	Insignificant	None	Opposite structure	Piping	Tœ□	Toe 🗍
~	Moderate	Occasional X	Adjacent structure	Flow failure	Lower bank	Lower bank
	Serious	Frequent	Dustream of structure	Ravelling	Upper bank	Upper bank
1	361X41	. requalit	Upstream of structure		Whole bank	Whole bank
				l .		
					· · · · · · · · · · · · · · · · · · ·	
1	PART 17: RIGHT	BANK BERM CHAR	ACTERISTICS			
	Present Status	Berm Materials	Berm Vegetation	Berm Tree Types	Density	Health
		Silt/clay	None 🗌	None 🔲	Nane 🗌	Healthy X
1	No berm			Alder	Sparce X	Unhealthy
	small berm	Sand/silt/clay	Cleared			
	small berm		Cleared Grass and flors X	Ash	Medium	Dead
		Sand/silt/clay				·
	small berm medium berm large berm	Sand/silt/clay Sand/silt Sand	Grass and flors X Reeds and sedges	Ash Birch	Medium Dense	Dead
	small berm medium berm large berm Berm Location	Sand/silt/clay Sand/silt	Grass and flora X Reeds and sedges Shrubs	Ash Birch Cottonwood X	Medium	Dead Height_
	small berm medium berm large berm Berm Location None	Sand/silt/clay Sand/silt Sand Sand Sand Gravel Gravel	Grass and flora X Reeds and sedges Shrubs Saplings X	Ash Birch Cottonwood X Elm	Medium Dense Diversity_	Dead Height Short X
	small berm medium berm large berm Berm Location None Only inside bends	Sand/silt/clay Sand/silt Sand Sand Sand/gravel Gravel Gravel/cobbles	Grass and flora X Reeds and sedges Shrubs	Ash Birch Cottonwood X Elm Beech	Medium Dense Diversity Mono-stand Mixed	Dead Height Short X Medium
	small berm medium berm large berm Berm Location None Only inside bends Continuous	Sand/silt/clay Sand/silt Sand Sand Sand/gravel Gravel Gravel Gravel Cobbles Cobbles	Grass and flora X Reeds and sedges Shrubs Saplings X Trees	Ash Birch Cottonwood X Elm Beech Sweet gum	Medium Dense Diversity Mono-stand Mixed Climax-vegetation	Height Short X Medium Tall
	small berm medium berm large berm Berm Location None Only inside bends Continuous Berm Material	Sand/silt/clay Sand/silt Sand Sand/gravel Gravel/Cobbles Cobbles Cobbles/boulders	Grass and flora X Reeds and sedges Shrubs Saplings X Trees Age	Ash Birch Cottonwood X Elm Beech Sweet gum Willow	Medium Dense Diversity Diversity Mono-stand Mixed Climax-vegetation Spacing	Height Short X Medium Tall Roots
	small berm modium berm large berm Berm Location None Only inside bends X Continuous Berm Material Size Data	Sand/silt/clay Sand/silt Sand/gravel Sand Sand Gravel Gravel/cobbles Cobbles Cobbles/boulders Boulders	Grass and flora X Reeds and sedges Shrubs Saplings X Trees A g e Irnature X	Ash Birch Cottonwood X Elm Beech Sweet gum	Medium Dense Diversity Mono-stand X Mixed Climax-vegetation Spacing Continuous	Dead Height Short X Medium Tall Reots Normal X
	small berm medium berm large berm Berm Location None Only inside bends Continuous Berm Material Size Data D50 (mm)	Sand/silt/clay Sand/silt Sand Sand/gravel Gravel/Cobbles Cobbles Cobbles/boulders	Grass and flora X Reeds and sedges Shrubs Saplings X Trees Age Imature X Mature X	Ash Birch Cottonwood X Elm Beech Sweet gum Willow	Medium Dense Diversity Mono-stand X Mixed Climax-vegetation Spacing Continuous Close X	Dead Height Short Medium Tall Roots Normal X
	small berm modium berm large berm Berm Location None Only inside bends X Continuous Berm Material Size Data	Sand/silt/clay Sand/silt Sand/gravel Sand Sand Gravel Gravel/cobbles Cobbles Cobbles/boulders Boulders	Grass and flora X Reeds and sedges Shrubs Saplings X Trees A g e Irnature X	Ash Birch Cottonwood X Elm Beech Sweet gum Willow	Medium Dense Diversity Mono-stand X Mixed Climax-vegetation Spacing Continuous	Dead Height Short X Medium Tall Reots Normal X

SEDIMENTATION ANALYSIS SHEET Developed by Colin R. Thome for the US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

RIVER CLEAR C	LEEK	SITE (Bouina i	REACH Farrah Bridge	ge Ti-Hontown Bridge
SHEET COMPLETED BY	Groups 1,2+3	DATE 10	-18-90 TIME: ST	ART 2: 10pm TE	ME: FINISH 4: 30pm
Г	SECTI	ON 1 - VALLEY AN	D CHANNEL SURVE	Y	
PART 1: AREA ARO					
Terrain	Geology		Land Use	V	F F
	~ , ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Rock Type		Vegetation	Forest Type
Mountains	Bed rock	Cemented Clay X	Natural 🗶	Hills None	None
Uplands[Moraine	Shale	Cultivated X	V.F. Grass 🗓	Z√r Deciduous X
Hills	Glacio/Fluvial	Limestone	Urban	Arable Crops 🔀	Consferous Consferous
Plains	Fluvial	Sandstone	_	Shrubs	Mixed
Lowlands	Lacustrine	Conglomerate		Forest X	H1, 113
ν	Vind blown (loess) 📉 (Hills) Granite[_
				k Fo valley	Floor
***************************************	· · · · · · · · · · · · · · · · · · ·				
PART 2: VALLEY S	IDES				
		Vallan alda	Savante:	Fallura Laurtiana	Fallura Turas
Height	Side	Valley side	•		Failure Types
< 20 feet	Slope Angle	Fallures	of Problems	None	None
20-50 feet X	< 30 degrees	None	Insignificant 🗶	Away from river	Shallow slide
50-100 feet		はらくか) Occasional 💢		Along river (Undercut)	Rotational slip
>100 feet		—		rtiong river (enderedit)	
>100 leet	>60 degrees	Frequent	Senous		Slab-type 🔀
					Piping
					Flow failure
<u> </u>					
PART 3: VERTICAL	RELATION OF CHA	NNEL TO VALLEY			
	nstability:extent		Overhank Dencite	Lances	1 Data
	· —	Terraces	Overbank Deposits	Levees	Levee Data
Adjusted	None	None	None	None 🔀	Height (f)
Incised X	Local X	Indefinate	Silt	Indefinate	Side Slope (o)
Aggraded	General	Fragmentary	Fine sand	⊢	5.00 5.0pt (0,
Aggianco [. —			Fragmentary	
	Reach scale	Continuous	Medium sand 🔀	Continuous	
Instability:Status	System wide	Number of terraces X	Coarse sand		Levee Failures
Insignificant	Regional scale	_	Grave)	Levee Type	None
Moderate(V)		mber of Terraces	_		Occasional
Moderate X		nber of Terraces	_	Natural	Occasional
Moderate X Serious		mber of Terraces rabove valley Floor	_		Occasional Frequent
				Natural	— 1
Serious	Numbe	r above valley Floor		Natural	— 1
Serious PART 4: LATERAL R	Numbe	r above valley Floor		Natural Man-made	Frequent
Serious PART 4: LATERAL R	Numbe	r above valley Floor	Planform Data	Natural	— 1
PART 4: LATERAL R Present Status II	Numbe	NNEL TO VALLEY Planform		Natural Man-made	Frequent
PART 4: LATERAL R Present Status II Adjusted	Numbe RELATION OF CHA! nstability:extent None	r above valley Floor NNEL TO VALLEY Planform Straight	Bend Radius	Natural Man-made Man-made Valley Floor Type None	Frequent Valley Floor Data <1 river width
PART 4: LATERAL R Present Status II Adjusted X over wide	Numbe RELATION OF CHA! nstability:extent None Local	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous	Bend Radius Meander belt width	Natural Man-made	Valley Floor Data <1 river width 1 - 5 river widths
PART 4: LATERAL Present Status II Adjusted Vover wide narrow	Number RELATION OF CHA! astability:extent None Local General	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous Irregular	Bend Radius Meander belt width Wavelength	Natural Man-made Man-made Valley Floor Type None	Frequent Valley Floor Data <1 river width
PART 4: LATERAL R Present Status II Adjusted X over wide	Numbe RELATION OF CHA! nstability:extent None Local	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous	Bend Radius Meander belt width	Natural Man-made	Valley Floor Data <1 river width 1 - 5 river widths
PART 4: LATERAL R Present Status II Adjusted X over wide narrow Instability: Status	Numbe RELATION OF CHA: nstability:extent None Local General Reach scale	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders	Bend Radius Meander belt width Wavelength	Natural Man-made Valley Floor Type None Indefinate Fragmentary	Valley Floor Data <1 nver width 1 - 5 river widths > 5 river widths
PART 4: LATERAL R Present Status II Adjusted Over wide narrow Instability: Status Insignificant	Numbe RELATION OF CHA! n stability : extent None Local General Reach scale System wide	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders	Bend Radius Meander belt width Wavelength	Natural Man-made Man-	Valley Floor Dats <1 river width 1 - 5 river widths > 5 river widths Note:
PART 4: LATERAL R Present Status II Adjusted Over wide narrow Instability: Status Insignificant Moderate	Numbe RELATION OF CHA: nstability:extent None Local General Reach scale	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Totuous meanders	Bend Radius Meander belt width Wavelength	Natural Man-made Man-	Valley Floor Data <1 nver width 1 - 5 niver widths > 5 niver widths
PART 4: LATERAL R Present Status II Adjusted Over wide narrow Instability: Status Insignificant	Numbe RELATION OF CHA! n stability : extent None Local General Reach scale System wide	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders	Bend Radius Meander belt width Wavelength	Natural Man-made Man-	Valley Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note:
PART 4: LATERAL R Present Status II Adjusted Over wide narrow Instability: Status Insignificant Moderate	Numbe RELATION OF CHA! n stability : extent None Local General Reach scale System wide	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Totuous meanders	Bend Radius Meander belt width Wavelength	Natural Man-made Man-	Valley Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note:
PART 4: LATERAL R Present Status II Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious	Numbe RELATION OF CHA! n stability : extent None Local General Reach scale System wide Regional scale	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Totuous meanders	Bend Radius Meander belt width Wavelength	Natural Man-made Man-	Valley Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note:
PART 4: LATERAL R Present Status II Adjusted Over wide narrow Instability: Status Insignificant Moderate	Numbe RELATION OF CHA! n stability : extent None Local General Reach scale System wide Regional scale	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Totuous meanders	Bend Radius Meander belt width Wavelength	Natural Man-made Man-	Valley Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note:
PART 4: LATERAL R Present Status II Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious	Numbe RELATION OF CHA! n stability : extent None Local General Reach scale System wide Regional scale	r above valley Floor [] NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Totuous meanders	Bend Radius Meander belt width Wavelength Meander Sinuosity	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X	Valley Floor Data <1 nver width 1 - 5 river widths > 5 river widths Note: h = channel top width
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate Serious PART 5: CHANNEL Dimensions	RELATION OF CHAINSTANDING CHAI	r above valley Floor NEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Irregular meanders Braided Bed Controls	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt	Valley Floor Data < 1 over width 1 · 5 river widths > 5 river widths Note: h = channel top width
PART 4: LATERAL R Present Status Adjusted over vide narrow Instability: Status Insignificant Moderate Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10	Numbe RELATION OF CHAI Instability:extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type 10 ft None	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None	Natural Man-made Man-	Valley Floor Data <1 nver width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None
PART 4: LATERAL R Present Status Adjusted Average Over wide narrow Instability: Status Insignificant Moderate Serious PART 5: CHANNEL Dimensions Ave. top bank width 100-100 Ave. channel depth 200	Numbe RELATION OF CHA! a stability extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type Of None Uniform/Tranquil	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None Occasional	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt Width Controls (None Occasional X	Valley Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock
PART 4: LATERAL R Present Status Adjusted over vide narrow Instability: Status Insignificant Moderate Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10	Numbe RELATION OF CHAI Instability:extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type 10 ft None	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None	Natural Man-made Man-	Valley Floor Data <1 nver width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None
PART 4: LATERAL R Present Status Instability: Status Insignificant Moderate Serious PART 5: CHANNEL Dimensions Ave. top bank width 10-10 Ave. channel depth 20 Ave. water width 20	Numbe RELATION OF CHA: nstability:extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type None Uniform/Tranquil Uniform/Rapid	r above valley Floor NEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Braided Bed Controls None Occasional Frequent	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock Boulders	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt Width Controls None Occasional X Frequent	Valley Floor Data < 1 nver width 1 - 5 niver widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulden
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width 60-10 Ave. water width 120 Ave. water width 120 Ave. water depth 12-1	RELATION OF CHAINSTAND	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None Occasional X Frequent Confined	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor	Width Controls Width Controls Frequent Occasional Frequent Confined	Valley Floor Data < 1 over width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor
PART 4: LATERAL R Present Status Adjusted X over vide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10 Ave. water width 20 Ave. water width 20 Ave. water depth 1-2. Reach slope 2	Numbe RELATION OF CHAINSTAND CHA	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls	Meander belt width Wavelength Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor Bridge aprons	Width Controls Width Controls Occasional Frequent Confined Number of controls	Valley Floor Data < 1 nver width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10 Ave. water width 20 Ave. water width 20 Ave. water depth 1-2 Reach slope 7 Mean velocity 1-3 Mean velocity 1-3	Numbe RELATION OF CHA: a stability extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type None Uniform/Tranquil Uniform/Tranquil Uniform/Rapid fe Pool+Riffle Tumbling fets Step-pool	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor	Width Controls Width Continuous Width Continuous Width Controls Occasional Frequent Confined Number of controls	Vailey Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Reverents Bridge abutments
PART 4: LATERAL R Present Status Adjusted X over vide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10 Ave. water width 20 Ave. water width 20 Ave. water depth 1-2. Reach slope 2	Numbe RELATION OF CHA: a stability extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type None Uniform/Tranquil Uniform/Tranquil Uniform/Rapid fe Pool+Riffle Tumbling fets Step-pool	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls	Meander belt width Wavelength Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor Bridge aprons	Width Controls Width Continuous Width Continuous Width Controls Occasional Frequent Confined Number of controls	Vailey Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Reverents Bridge abutments
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10 Ave. water width 20 Ave. water width 20 Ave. water depth 1-2 Reach slope 7 Mean velocity 1-3 Mean velocity 1-3	Numbe RELATION OF CHA: a stability extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type None Uniform/Tranquil Uniform/Tranquil Uniform/Rapid fe Pool+Riffle Tumbling fets Step-pool	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls	Meander belt width Wavelength Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor Bridge aprons	Width Controls Width Continuous Width Continuous Width Controls Occasional Frequent Confined Number of controls	Valley Floor Data < 1 nver width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10 Ave. water width 20 Ave. water width 20 Ave. water depth 1-2 Reach slope 7 Mean velocity 1-3 Mean velocity 1-3	Numbe RELATION OF CHA: a stability extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type None Uniform/Tranquil Uniform/Tranquil Uniform/Rapid fe Pool+Riffle Tumbling fets Step-pool	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls	Meander belt width Wavelength Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor Bridge aprons	Width Controls Width Continuous Width Continuous Width Controls Occasional Frequent Confined Number of controls	Vailey Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Reverents Bridge abutments
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10 Ave. water width 20 Ave. water width 20 Ave. water depth 1-2 Reach slope 7 Mean velocity 1-3 Mean velocity 1-3	Numbe RELATION OF CHAINSTAND CHA	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls Gra	Meander belt width Wavelength Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor Bridge aprons	Width Controls Width Continuous Width Continuous Width Controls Occasional Frequent Confined Number of controls	Vailey Floor Data < 1 river width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Reverents Bridge abutments
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to- Ave. water width 20 Ave. water width 20 Ave. water depth 1-2 Reach slope 7 Mean velocity 1-3 Manning's n value 20 PART 7: BED SEDIM	Numbe RELATION OF CHA: nstability:extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type Voite None Uniform/Tranquil Uniform/Rapid fe Pool+Riffle X Tumbling Aris Step-pool 35	r above valley Floor NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Tortuous meanders Braided Bed Controls None Occasional Frequent Confined Number of controls Gra	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor Bridge aprons de control structures Bed Forms	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous Width Width Controls None Occasional Frequent Confined Number of controls	Valley Floor Data < 1 nver width 1 - 5 niver widths 3 - 5 niver widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Reverements Bridge abutments Adykes or groynes
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to-ic Ave. water width to-ic Reach slope 7 Mean velocity 1-34 Manning's n value 2009 PART 7: BED SEDIM Bed Material	Numbe RELATION OF CHA: nstability:extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type Of None Uniform/Tranquil Uniform/Tranquil Uniform/Rapid fe Pool+Riffle X Tumbling Aris Step-pool Bed Armour	NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Irregular meanders Braided Bed Controls None Occasional Frequent Confined Number of controls Gra Surface Size Data	Bend Radius Meander belt width Wavelength Meander Sinuositv Control Types None Bedrock Boulders Gravel armor Bridge aprons de control structures Bed Forms Plane bed	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt Width Controls None Occasional X Frequent Confined Number of controls Bar Types	Valley Floor Data < 1 nver width 1 · 5 niver widths > 5 niver widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments X Bridge abutments X dykes or groynes Bar Surface data
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width 60-10 Ave. water width 20 Ave. water depth 10-2 Reach slope 7 Mean velocity 1-34 Manning's n value 20 PART 7: BED SEDIM Bed Material Silt	Numbe RELATION OF CHAINSTAND CHA	r above valley Floor NEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Praided Bed Controls None Occasional X Frequent Confined Number of controls Gra Surface Size Data D50 (mm)	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor Bridge aprons de control structures Bed Forms Plane bed Ripples	Width Controls Width Controls Continuous X Width Controls None Occasional X Frequent Confined Number of controls Bar Types None	Valley Floor Data < 1 nver width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments X Bridge abutments X dykes or g roynes Bar Surface data D50 (mm)
PART 4: LATERAL R Present Status Adjusted X over vide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10 Ave. water width 20 Ave. water depth 12-2 Reach slope 7 Mean velocity 1-3 Manning's n value 2 PART 7: BED SEDIM Bed Material Silt Sand	Numbe RELATION OF CHAINSTAND CHA	NNEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Irregular meanders Braided Bed Controls None Occasional Frequent Confined Number of controls Gra Surface Size Data	Bend Radius Meander belt width Wavelength Meander Sinuositv Control Types None Bedrock Boulders Gravel armor Bridge aprons de control structures Bed Forms Plane bed	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt Width Controls None Occasional X Frequent Confined Number of controls Bar Types	Valley Floor Data < 1 nver width 1 · 5 niver widths > 5 niver widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments X Bridge abutments X dykes or groynes Bar Surface data
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate Serious PART 5: CHANNEL Dimensions Ave. top bank width 60-10 Ave. water width 20 Ave. water depth 10-2 Reach slope 7 Mean velocity 1-34 Manning's n value 20 PART 7: BED SEDIM Bed Material Silt	Numbe RELATION OF CHAINSTAND CHA	Regular meanders Irregular meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls Gradument Confined Number of Surface Size Data D50 (mm) D84 (mm)	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor Bridge aprons de control structures Bed Forms Plane bed Ripples Dunes Dunes	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous Width Controls None Occasional X Frequent Confined Number of controls Bar Types None Pools and riffles X	Valley Floor Data < 1 nver width 1 - 5 niver widths > 5 niver widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments X Bridge abutments X dykes or groynes Bar Surface data D50 (mm) D84 (mm)
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to to Ave. channel depth to Ave. water width to Ave. water width to Ave. water width to Ave. water width to Ave. water side to Ave. water side to Ave. water width to Ave. water side to Ave. wat	Numbe RELATION OF CHA: nstability:extent None Local General Reach scale System wide Regional scale DESCRIPTION Flow Type Of None Uniform/Rapid fe Pool+Riffle X Tumbling Arb Step-pool Step-pool Bed Armour None Static-armour Mobile-armour	r above valley Floor NEL TO VALLEY Planform Straight Sinuous Irregular Regular meanders Irregular meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls Gra Surface Size Data D50 (mm) D84 (mm) sorting coefficient	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock Boulders Gravel armor Bridge aprons de control structures Bed Forms Plane bed Ripples Dunes Bed form height (ft)	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt Width Controls None Occasional X Frequent Confined Number of controls Bar Types None Pools and riffles Alternate bars X	Valley Floor Data < 1 nver width 1 - 5 niver widths > 5 niver widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments Bridge abutments Adykes or groynes Bar Surface data D50 (mm) D84 (mm) sorting coef.
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate Serious PART 5: CHANNEL Dimensions Ave. top bank width 100 Ave. channel depth 200 Ave. water width 200 Ave. water significant and significant and gravel 200 PART 7: BED SEDIM Bed Material Silt Sand Sand and gravel X gravel and cobbles	RELATION OF CHAINSTAND	Regular meanders Irregular meanders Irregular meanders Irregular meanders Irregular meanders Irregular meanders Irregular meanders Braided Bed Controls None Occasional Frequent Confined Number of controls Gra	Bend Radius Meander belt width Wavelength Meander Sinuositv Control Types None Bedrock Boulders Gravel armor Bridge aprons de control structures Bed Forms Plane bed Ripples Dunes Bed form height (ft) Island or Bars	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt Width Controls None Occasional X Frequent Confined Number of controls Bar Types None Pools and riffles X Alternate bars Point bars X	Valley Floor Data < 1 nver width 1 - 5 niver widths > 5 niver widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments X Bridge abutments X dykes or groynes Bar Surface data D50 (mm) D84 (mm) Sorting coef Bar Substrate data
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate X Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10 Ave. channel depth 20 Ave. water depth 10-24 Reach slope 7 Mean velocity 1-34 Manning's n value 20 PART 7: BED SEDIM Bed Material Silt Sand Sand and gravel X gravel and cobbles cobbles + boulders	Numbe RELATION OF CHAINSTAND CHA	r above valley Floor Planform Straight Sinuous Irregular Regular meanders Irregular meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls Gra Surface Size Data D50 (mm) D84 (mm) sorting coefficient ubstrate Size Data D50 (mm)	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock Bouldern Gravel armor Bridge aprons de control structures Bed Forms Plane bed Ripples Dunes Bed form height (fi) Island or Bars None	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt Width Controls None Occasional X Frequent Confined Number of controls Bar Types None Pools and niffes X Alternate bars X Point bars X Mid-channel bars X	Valley Floor Data < I nver width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments X Bridge abutments X dykes or g roynes Bar Surface data D50 (mm) D84 (mm) sorting coef. Bar Substrate data D50 (mm)
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate Serious PART 5: CHANNEL Dimensions Ave. top bank width 100 Ave. channel depth 200 Ave. water width 200 Ave. water significant and significant and gravel 200 PART 7: BED SEDIM Bed Material Silt Sand Sand and gravel X gravel and cobbles	RELATION OF CHAINSTAND	Regular meanders Irregular meanders Irregular meanders Irregular meanders Irregular meanders Irregular meanders Irregular meanders Braided Bed Controls None Occasional Frequent Confined Number of controls Gra	Bend Radius Meander belt width Wavelength Meander Sinuositv Control Types None Bedrock Boulders Gravel armor Bridge aprons de control structures Bed Forms Plane bed Ripples Dunes Bed form height (ft) Island or Bars	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt Width Controls None Occasional X Frequent Confined Number of controls Bar Types None Pools and riffles X Alternate bars Point bars X	Valley Floor Data < 1 nver width 1 - 5 niver widths > 5 niver widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Revetments X Bridge abutments
PART 4: LATERAL R Present Status Adjusted X over wide narrow Instability: Status Insignificant Moderate Serious PART 5: CHANNEL Dimensions Ave. top bank width to 10 Ave. channel depth 20 Ave. water width 20 Ave. water depth 1-2. Reach slope 7 Mean velocity 1-3 Manning's n value 2 PART 7: BED SEDIM Bed Material Silt Sand Sand and gravel X gravel and cobbles cobbles + boulders boulders + bedrock	Numbe RELATION OF CHAINSTAND CHA	r above valley Floor Planform Straight Sinuous Irregular Regular meanders Irregular meanders Braided Bed Controls None Occasional X Frequent Confined Number of controls Gra Surface Size Data D50 (mm) D84 (mm) sorting coefficient ubstrate Size Data D50 (mm)	Bend Radius Meander belt width Wavelength Meander Sinuosity Control Types None Bedrock Bouldern Gravel armor Bridge aprons de control structures Bed Forms Plane bed Ripples Dunes Bed form height (fi) Island or Bars None	Natural Man-made Valley Floor Type None Indefinate Fragmentary Continuous X widt Width Controls None Occasional X Frequent Confined Number of controls Bar Types None Pools and niffes X Alternate bars X Point bars X Mid-channel bars X	Valley Floor Data < 1 nver width 1 - 5 river widths > 5 river widths Note: h = channel top width Control Types None Bedrock Boulders Gravel armor Reverments X Bridge abutments X dykes or groynes Bar Surface data D50 (mm) D84 (mm) sorting coef. Bar Substrate data D50 (mm)

Sub-REACH 1 - 13+ Bend

		SECTION 2 · LEFT	BANK SURVEY		
PART 8: LEFT BA	NK CHARACTERIST	rics			1
Туре	Bank Materials M	ean Bank Height	Layer Thickness	Tension Cracks	Crack Extent
Noncohesive	Silt/clay □	Average height (ft)	•	None	Proportion of
		Average neight (11)[24			
Cohesive	Sand/silt/clay		Matenai 2 (fi)	Occasional	bank height
Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	
Layered	Sand 🔀	Average angle (0) 30	Material 4 (ft)	• —	
Even Layers	Sand/gravel		٠,٠		
		St. 4 15 . 41			
Thick+thin layers	Gravel				k Profile
Number of layers	Gravel/cobbles	Material Type 1	Material Type 2	Material Type 3 R	Material Type 4
_	Cobbles	Toe□	Tœ□	Tœ□	Tœ□
Protection Status	Cobbles/boulders	Mid-Bnak	Mid-Bnak	Mid-Bnak	
_			_		Mid-Bnak
Unprotected X	Boulders/bedrock	Upper Bank	Upper Bank	Upper Bank	Upper Bank
Hard points		Whole Bank 🗙	Whole Bank	Whole Bank	Whole Bank
Reverments		D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
Dyke Fields		` ' 	sorting coefficient		i power
Dyke reads [sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
			_		
PART 9: LEFT BA	NK-FACE VEGETAT	TION			
Vegetation		Density	Location	Wastab	174,1-44
_	Tree Types	· —		Health	Height
None	None	None	Whole bank	Healthy 🗶	Short
Cleared	Alder 🗀	Sparce		and over Fair	Medium X
	on Bank Ash	Medium X	Mid-bank	Poor	Tall
		100			1 m []
Reeds and sedges	Beech	Dense	Bank toe	Dead	
Shrubs	Birch B	-	_	_	
Saplings	On Sank Bilch	Spacing	Diversity	Age	Extent
			· —	, î. î. î	1
Trees X	Elm	Continuous	Mono-stand	Imature 🗶	Wide
	Sweet gum	Close	Mixed X	Mature 🗙	Medium X
Overbank	Willow	30 ft Wide	Climax-vegetation	Oul T	Narrow
				~□	
<u> </u>		DIVE (100MA)K			
	ANK EROSION PRO	CESSES			
Status	Extent	Location	Processes	Distribution of Each	Process on Bank
Intact	Toe 🗍	General	Flow entrainment	Process 1	Process 2
Eroding	Lower bank 🔀	Outside Meander	Piping	Toe X	Toe
Advancing X	Upper bank	Inside Meander 🔀	Freeze/thaw	Lower bank X	Lower bank
	Whole bank	Opposite a bar	Sheet erosion	Upper bank	Upper bank
Severity	Estimated rate	Behind a bar	Rilling + gullying	Whole bank	
Severity	Estimated rate	Dening a partial	KILLING + #ULIVINGS I		Whole bank
· —					البيبا
Insignificant	< 3ft/yr ☐	Opposite a structure	Wind waves	Process 3	Process 4
Insignificant	· —	Opposite a structure	Wind waves	Process 3	Process 4
Insignificant Mild	3 - 10 ft/yr	Opposite a structure Adjacent to structure	Wind waves Vessel Forces	Process 3	Process 4
Insignificant Mild Significant X	3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure	Wind waves Vessel Forces loe rafting	Process 3 Toe Lower bank	Process 4 Toe Lower bank
Insignificant Mild	3 - 10 ft/yr	Opposite a structure Adjacent to structure	Wind waves Vessel Forces	Process 3	Process 4
Insignificant Mild Significant X	3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant X Serious	3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure	Wind waves Vessel Forces loe rafting	Process 3 Toe Lower bank	Process 4 Toe Lower bank
Insignificant Mild Significant X Serious	3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant Serious Catastrophic	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild Significant Serious Catastrophic	3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank Whole bank	Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant Serious Catastrophic	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant Serious Catastrophic	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank Whole bank	Process 4 Toc Lower bank Upper bank Whole bank Whole bank
Insignificant Mild Significant X Serious Catastrophic	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >NK FAILURE MEC	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location	Wind waves Vessel Forces loe rafung Aeolian Other Fallure Mode	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1	Process 4 Toc Lower bank Upper bank Whole bank Mode on Bank Mode 2
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA	3 - 10 fu/yr 10 - 25 fu/yr >25 fu/yr >25 fu/yr Total Tot	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General	Wind waves Vessel Forces lee rafung Aeolian Other Fallure Mode Shallow slide	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Toe	Toe Dank Upper bank Whole bank Mode 2 Toe Toe Toe
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander	Wind waves Vessel Forces loe rafung Aeolian Other Fallure Mode	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank	Process 4 Toc Lower bank Upper bank Whole bank Whole on Bank Mode 2 Toc Lower bank
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA	3 - 10 fu/yr 10 - 25 fu/yr >25 fu/yr >25 fu/yr Total Tot	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General	Wind waves Vessel Forces lee rafung Aeolian Other Fallure Mode Shallow slide	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Toe	Toe Dank Upper bank Whole bank Mode 2 Toe Toe Toe
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >Extent Toe Lower bank Upper bank	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander	Wind waves Vessel Forces lee rafung Acolian Other Failure Mode Shallow slide Rotational slip Slab-type	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank	Process 4 Toc Lower bank Upper bank Whole bank Whole bank Mode 0n Bank Mode 2 Lower bank Upper bank
Insignificant Mild Significant X Serious Catastrophic PART 11: LEFT BA Status Stable X Unreliable Unstable	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar	Wind waves Vessel Forces lee rafung Aeolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank	Process 4 Toc Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toc Lower bank Upper bank Upper bank Whole bank
Insignificant Mild Significant X Serious Catastrophic PART 11: LEFT BA Status Stable X Unreliable Unstable Severity	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Nopposite a bar Behind a bar	Wind waves Vessel Forces lee rafung Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Upper bank Whole bank Mode 3	Mode on Bank Mode on Bank Mode 2 Toc Lower bank Whole bank Mode 2 Toc Lower bank Upper bank Whole bank Mode 4
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA Status Sable Unreliable Unstable Severity Insignificant	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar	Wind waves Vessel Forces lee rafung Aeolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank	Process 4 Toc Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toc Lower bank Upper bank Upper bank Whole bank
Insignificant Mild Significant X Serious Catastrophic PART 11: LEFT BA Status Stable X Unreliable Unstable Severity	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Nopposite a bar Behind a bar	Wind waves Vessel Forces lee rafung Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe	Mode on Bank Mode on Bank Whole bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Toe Toe Toe Toe Toe Toe Toe To
Insignificant Mild Significant X Serious Catastrophic PART 11: LEFT BA Status Stable X Unreliable Unstable Severity Insignificant X Moderate Moderate	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Wind waves Vessel Forces lee rafung Aeolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Lower bank Lower bank Lower bank Lower bank Lower bank Lower bank	Mode on Bank Mode 2 Lower bank Upper bank Whole bank Mode 2 Lower bank Upper bank
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA Status Sable Unstable Unstable Severity Insignificant	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Inside Meander Sephind a bar Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Wind waves Vessel Forces lee rafung Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Mode on Bank Whole bank Whole bank Whole bank Whole bank Mode 2 Toe Lower bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant X Serious Catastrophic PART 11: LEFT BA Status Stable X Unreliable Unstable Severity Insignificant X Moderate Moderate	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Wind waves Vessel Forces lee rafung Aeolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Lower bank Lower bank Lower bank Lower bank Lower bank Lower bank	Mode on Bank Mode 2 Lower bank Upper bank Whole bank Mode 2 Lower bank Upper bank
Insignificant Mild Significant X Serious Catastrophic PART 11: LEFT BA Status Stable X Unreliable Unstable Severity Insignificant X Moderate Moderate	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Inside Meander Sephind a bar Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Wind waves Vessel Forces lee rafung Aeolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Mode on Bank Whole bank Whole bank Whole bank Whole bank Mode 2 Toe Lower bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant X Serious Catastrophic PART 11: LEFT BA Status Stable X Unreliable Unstable Severity Insignificant X Moderate Moderate	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Inside Meander Sephind a bar Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Wind waves Vessel Forces lee rafung Aeolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Mode on Bank Whole bank Whole bank Whole bank Whole bank Mode 2 Toe Lower bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Severity Insignificant Moderate Serious	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Locatioa General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Wind waves Vessel Forces lee rafung Aeolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Mode on Bank Whole bank Whole bank Whole bank Whole bank Mode 2 Toe Lower bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unsignificant Moderate Serious PART 12: LEFT BA	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Inside Meander Sopposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Whole bank Whole bank	Mode on Bank Whole bank
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA Status Stable X Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT BA Present Status	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Whole bank Frequency Nome Occasional Frequent ANK BERM CHARA Berm Materials	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other Location General Outside Meander Inside Meander Inside Meander Opposite a bar Opposite structure Adjacent structure Dnstream of structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure	Vind waves Vessel Forces lee rafung Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Berm Tree Types	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Whole bank Upper bank	Mode on Bank Whole bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Whole bank Whole bank Upper bank
Insignificant Mild Significant Serious Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable Unsignificant Moderate Serious PART 12: LEFT BA	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other Location General Outside Meander Inside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Onstream of structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Whole bank Whole bank	Mode on Bank Whole bank
Insignificant Mild Significant Serious Catastrophic Status Status Stable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT B/Present Status	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Whole bank Frequency Nome Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other Location General Outside Meander Inside Meander Inside Meander Opposite a bar Opposite structure Adjacent structure Dnstream of structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure	Wind waves Vessel Forces lee rafung Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Node 3 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank	Mode on Bank Whole bank Mode 2 Toc Lower bank Upper bank Whole bank Upper bank Upper bank Upper bank Whole bank Health Health
Insignificant Mild Significant Serious Catastrophic Status Status Stable Unreliable Unstable Severity Insignificant Moderate Serious PART 12: LEFT By Present Status Status Stable Unreliable Unstable Serious No berm small berm	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure CTERISTICS Berm Vegetation None Cleared	Wind waves Vessel Forces lee rafung Acolian Other Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Density None Sparce	Mode on Bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Upper bank Whole bank Whole bank Health Health Health Health
Insignificant Mild Significant Serious Catastrophic Status Stable Unreliable Unstable Severity Insignificant Moderate Serious Serious PART 12: LEFT By Present Status No verm small berm medium berm medium berm Moderate Serious Seri	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Opposite a bar Opposite a tructure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berss Vegetation None Cleared Grass and flors	Fallure Mode Shallow slide Rotational slip Slab-type Popout failure Piping Flow failure Ravelling Berm Tree Types None Alder Ash	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Whole bank Whole bank	Mode on Bank Whole bank Whole bank Mode 2 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Health Health
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Insignificant Mild Significant Serious Catastrophic Serious Catastrophic Status Stable Unreliable Unstable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT B. Present Status No term small berm medium berm I large berm Berm Location None Only inside bends Continuous Berm Material Size Data D50 (mm)	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Gravel/Cobbles Cobbles/Cobbles Cobbles/Cobbles	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other Location General Outside Meander Inside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure Upstream of structure Upstream of structure Series Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees	Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Flow failure Ravelling Flow failure Cantilever failure Piping Flow failure Cantilever failure Ravelling Willow Other (specify)	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper ba	Mode on Bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Upper bank Whole bank Whole bank Whole bank Upper bank
Insignificant Mild Significant Significant Serious Catastrophic Serious Catastrophic Status Stable Unreliable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT By Present Status No berm small berm medium berm medium berm berm Location None Only inside bends Continuous Berm Material Size Data	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Sil/clay Sand/sil/clay Sand/sil/clay Sand/sil/clay Sand/sil/clay Cobbles Cobbles Cobbles Cobbles Cobbles Boulders Boulders	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Cuber HANICS Location General Outside Meander Inside Meander Opposite a bar Opposite a bar Opposite a structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berss Vegetation None Cleared Grass and flora Reads and sedges Shrubs Saplings Trees Age Imature	Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Flow failure Ravelling Flow failure Cantilever failure Piping Flow failure Cantilever failure Ravelling Willow Other (specify)	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper ba	Mode on Bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank Upper bank Whole bank Whole bank Whole bank Health Health Health Health Health Health Roots Normal
Insignificant Mild Significant Serious Catastrophic Serious Catastrophic Status Stable Unreliable Unstable Unstable Unstable Unstable Severity Insignificant Moderate Serious PART 12: LEFT B. Present Status No term small berm medium berm I large berm Berm Location None Only inside bends Continuous Berm Material Size Data D50 (mm)	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Sil/clay Sand/sil/clay Sand/sil/clay Sand/sil/clay Sand/sil/clay Cobbles Cobbles Cobbles Cobbles Cobbles Boulders Boulders	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure Citerated Grass and flora Reeds and sedges Shrubs Saplings Trees Age Imature Mature	Fallure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Flow failure Ravelling Flow failure Cantilever failure Piping Flow failure Cantilever failure Ravelling Willow Other (specify)	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper ba	Mode on Bank Whole bank

REACH 2 - 2nd Bend
SECTION 2 - LEFT BANK SURVEY

PART 8: LEFT BA!					
Type	Bank Materials M		Lager Thickness		Crack Extent
Noncohesive X	Silt/clay	Average height (ft)	Material 1 (ft) 15		Proportion of
Cohesive	Sand/silt/clay		Material 2 (ft)	Occasional	bank height
Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent[]	ĺ
Layered	Sand /	Average angle (0)	Material 4 (ft)		
Even Layers	Sand/gravel	m			
Thick+thin layers	Gravel			Bank Materials in Bani	
Number of layers	Gravel/cobbles	Material Type 1 Toe	Material Type 2	Material Type 3 V	faterial Type 4
S	Cobbles		Mid-Bnak	Mid-Bnak	Toe
Protection Status	Cobbles/boulders	Mid-Bnak	—	Upper Bank	Mid-Bnak
Unprotected X	Boulders/bedrock	Upper Bank Whole Bank X	Upper Bank Whole Bank	Whole Bank	Upper Bank Whole Bank
Hard points		D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
Revetments Dyke Fields		sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
Dyke Pasas		sorting coefficient	sorting coefficient	sorming coefficient	soming coer.
<u></u>					
PART 9: LEFT BA	NK-FACE VEGETAT	TION	_ ^		
Vegetation	Tree Types	Density	Location	Health	Height
None	None X	None	Whole bank	Healthy	Short
Cleared	Alder	Sparce	Bank top	Fair	Medium
Grass and flora	Ash	Medium	Mid-bank	Poor	Tall
Reeds and sedges	Beech	Dense 🗌	Bank toe 💢	Dead 🗔	
Shrubs	Birch 🗌			_	Į.
Saplings	Cottonwood	Spacing	Diversity	Age	Extent
Trees	Elm 🗌	Continuous	Mono-stand	Imature	Wide 🔲
_	Sweet gum	Close	Mixed	Mature	Medium
	Willow	W≱te ∑	Climax-vegetation	Ord 🗌	Narrow 🔲
				·	
	NK EROSION PRO		_		
Status	Extent	Location	Processes	Distribution of Each	
Intact	Toe	General	Flow entrainment	Process 1	Process 2
Eroding X	Lower bank	Outside Meander	Piping 2	Toe	Toe
Advancing	Upper bank	Inside Meander	Freeze/thaw	Lower bank	Lower bank X
	Whole bank	Opposite a bar X	Sheet erosion	Upper bank	Upper bank
Severity	Estimated rate	Behind a bar	Rilling + gullying	Whole bank X	Whole bank []
	🗖	. н		انظ	
Insignificant	< 3ft/yr	Opposite a structure	Wind waves	Process 3	Process 4
Insignificant Mild	3 - 10 ft/yr	Adjacent to structure	Wind waves Vessel Forces	Process 3	Toe 🔲
Insignificant Mild Significant	3 - 10 ft/yr 10 - 25 ft/yr	Adjacent to structure Dostream of structure	Wind waves Vessel Forces Ice rafting	Process 3 Toe Lower bank	Toe Lower bank
Insignificant Mild Significant Serious X	3 - 10 ft/yr	Adjacent to structure Dostream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Toe Lower bank Upper bank
Insignificant Mild Significant	3 - 10 ft/yr 10 - 25 ft/yr	Adjacent to structure Dostream of structure	Wind waves Vessel Forces Ice rafting	Process 3 Toe Lower bank	Toe Lower bank
Insignificant Mild Significant Serious X	3 - 10 ft/yr 10 - 25 ft/yr	Adjacent to structure Dostream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Toe Lower bank Upper bank
Insignificant Mild Significant Serious X Catastrophic	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr	Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Toe Lower bank Upper bank
Insignificant Mild Significant Serious X Catastrophic	3 - 10 ft/yr 10 - 25 ft/yr	Adjacent to structure Distream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toc Lower bank Upper bank Whole bank	Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant Serious X Catastrophic	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr 3	Adjacent to structure Distream of structure Upstream of structure Other HANICS	Wind waves Vessel Forces Ice rafting Aeolian Other	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each	Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT BA	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr NK FAILURE MEC	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location	Wind waves Vessel Forces Ice rafting Aeolian Other	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr LNK FAILURE MEC Extent Toe	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General	Wind waves Vessel Forces Ice rafting Aeolian Other Failure Mode Shallow slide	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT BA Status Stable Unreliable	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toc Lower bank	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide Rotational slip	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Upper bank	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander	Wind waves Vessel Forces Ice rafting Aeolian Other Failure Mode Shallow slide / Rotational slip Slab-type 2	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank
Insignificant Mild Significant Serious X Catastrophic PART II: LEFT BA Status Stable Unreliable Unstable X	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide Rotational slip	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Upper bank	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT BA Status Stable Unreliable Unstable X Severity	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Toe Lower bank Upper bank	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar	Wind waves Vessel Forces Ice rafting Aeolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Upper bank Whole bank	Toe Lower bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable Insignificant	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr LOWER BECLE Extent Toe Lower bank Upper bank Whole bank Frequency None	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide [Rotational slip Slab-type 2 Pop-out failure Cantilever failure Piping 3	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Toc Toc Toc	Toe Lower bank Upper bank Whole bank Mode 08 Bank Mode 2 Toe Lower bank Upper bank Upper bank Whole bank Mode 4 Toe
Insignificant Mild Significant Serious X Catastrophic PART II: LEFT B/ Status Stable Unreliable Unstable Unstable Verity Insignificant Moderate	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide / Rotational slip Rotational slip Slab-type 2 Pop-out failure Cantilever failure Piping 3 Flow failure	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Upper bank Upper bank Upper bank Toc Lower bank	Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Lower bank Lower bank
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable Insignificant	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr LOWER BECLE Extent Toe Lower bank Upper bank Whole bank Frequency None	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide [Rotational slip Slab-type 2 Pop-out failure Cantilever failure Piping 3	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Toc Toc Toc	Toe Lower bank Upper bank Whole bank Mode 08 Bank Mode 2 Toe Lower bank Upper bank Upper bank Whole bank Mode 4 Toe
Insignificant Mild Significant Serious X Catastrophic PART II: LEFT B/ Status Stable Unreliable Unstable Unstable Verity Insignificant Moderate	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide / Rotational slip Rotational slip Slab-type 2 Pop-out failure Cantilever failure Piping 3 Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant Serious X Catastrophic PART II: LEFT B/ Status Stable Unreliable Unrable X Severity Insignificant Moderate Serious X	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Too Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide / Rotational slip Rotational slip Slab-type 2 Pop-out failure Cantilever failure Piping 3 Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant Serious X Catastrophic PART II: LEFT B/ Status Stable Unreliable Unrable X Severity Insignificant Moderate Serious X	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Failure Mode Shallow slide / Rotational slip Rotational slip Slab-type 2 Pop-out failure Cantilever failure Piping 3 Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable Vistable Unstable Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide [Rotational slip Slab-type 2 Pop-out failure Cantilever failure Piping 3 Flow failure Ravelling Berm Tree Types	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Upper bank Whole bank Health
Insignificant Mild Significant Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable X Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status Soberm X	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silvclay	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure OTERISTICS Berim Vegetation None	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Berm Tree Types None	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank	Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Whole bank Health Healthy
Insignificant Mild Significant Serious X Catastrophic PART II: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable X Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm Imail berm	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NK FAILURE MEC Extent Too Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Sil/clay Sand/silt/clay	Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Whole bank Upper bank Whole bank Whole bank Whole bank Whole bank	Toe Lower bank Upper bank Whole bank Mode 08 Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Health Health Health
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable Unstable Vinsignificant Moderate Serious PART 12: LEFT B/ Present Status No berm Imal ber	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt	Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide // Rotational slip Slab-type 2 Pop-out failure Paping 3 Flow failure Ravelling Berm Tree Types Nome Alder Ash	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank	Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Whole bank Health Healthy
Insignificant Mild Significant Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable X Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm madium berm medium berm large berm	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Sil/clay Sand/silt/clay Sand/silt/clay Sand/silt/sand	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide [Rotational slip Slab-type 2 Pop-out failure Cantilever failure Piping 3 Flow failure Ravelling Berm Tree Types None Alder Ash Birch	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Health Health Upper bank
Insignificant Mild Significant Serious X Catastrophic Status Stable Unreliable Unstable Unstable William Moderate Serious X PART 12: LEFT By Present Status No berm Jimall berm large berm Lecation Berm Lecation	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Whole bank Frequent Occasional Frequent ANK BERM CHARA Berm Materials Sil/clay Sand/silf(clay Sand/silf(sand/silf) Sand Sand/gravel	Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank	Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Whole bank Health Health Unhealthy Dead Height
Insignificant Mild Significant Serious X Catastrophic PART II: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable Vinsignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm Imall berm Imall berm Indium berm Iarge berm Berm Lecation None X	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Sül/clay Sand/sült/clay Sand/sült/clay Sand/sült/clay Sand/gravel Gravel	Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Eim	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Density None Sparce Medium Density Mono-stand	Toe Lower bank Upper bank Whole bank Mode 0n Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Health Health Health Health Upper Unhealthy Dead Height Short
Insignificant Mild Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable V Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm V Insignificant Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm V Insignificant Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm V Insignificant Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm V Insignificant Insignificant Moderate Serious X Only inside benda V Insignificant Ins	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Frequent Salt/clay Sand/silt/clay Sand/silt/clay Sand/salt/clay Gravel Gravel Gravel Gravel Gravel	Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide [Rotational slip Slab-type 2 Pop-out failure Paping 3 Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beecch	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Diversity Mono-stand Mixed	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Health Health Health Health Health Health Health Health Health Short Medaum
Insignificant Mild Significant Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable X Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm mail berm medium berm large berm large berm Berm Lecation None X Only inside bends Continuous	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Whole bank Frequency None Occasional Frequent Sil/clay Sand/sil/clay Sand/sil/clay Sand/sil/clay Sand/sil/clay Sand/sil/clay Gravel Gravel Gravel Gravel/Cobbles Cobbles	Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide [Rotational slip Slab-type 2 Pop-out failure Cantilever failure Ravelling Berm Tree Types None Akter Ash Birch Cottonwood Elm Beech Swest gum	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Upper ba	Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Health
Insignificant Mild Significant Mild Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable X Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status So berm Mindium berm large berm Moderate Derm Unstable	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt Sand/gravel Gravel/Cobbles Cobbles/boulders	Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum Willow	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Whole bank Dense Diversity Mono-stand Mixed Climax-vegetation Spacing	Toe Lower bank Upper bank Whole bank Mode 08 Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Health Health Health Health Upper bank Whole bank Whole bank Realth Health Health Health Health Health Roots
Insignificant Mild Significant Mild Significant Serious X Catastrophic PART II: LEFT B/ Status Stable Unreliable Unstable Unstable X Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm Mild berm Indiang Berm Material Size Data	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Sül/clay Sand/sült/clay Sand/sült/clay Sand/sült/clay Gravel Gravel Gravel Gravel Cobbles Cobbles/boulders Boulden	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Cested Grass and flora Reeds and sedges Shrubs Saplings Trees	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide [Rotational slip Slab-type 2 Pop-out failure Cantilever failure Ravelling Berm Tree Types None Akter Ash Birch Cottonwood Elm Beech Swest gum	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Density None Sparce Medium Diversity Mono-stand Mixed Climax-vegetation Spacing Continuous	Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Health Health Health Health Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Normal Health Health Health Health Health Health Health Unhealthy Dead
Insignificant Mild Significant Mild Significant Serious X Catastrophic PART 11: LEFT B/ Status Stable Unreliable Unstable Unstable Unstable X Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm Jimall berm medium berm large berm Berm Lecation None X Only inside bends Continuous Berm Material Size Data D50 (mm)	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr NNK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt Sand/gravel Gravel/Cobbles Cobbles/boulders	Adjacent to structure Dnstream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees Age Institute Masure	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum Willow	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Clower bank Upper bank U	Toe Lower bank Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Health Health Health Health Health Health Health Roots Normal Advantuous
Insignificant Mild Significant Mild Significant Serious X Catastrophic PART II: LEFT B/ Status Stable Unreliable Unstable Unstable X Severity Insignificant Moderate Serious X PART 12: LEFT B/ Present Status No berm Mild berm Indiang Berm Material Size Data	3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent ANK BERM CHARA Berm Materials Sül/clay Sand/sült/clay Sand/sült/clay Sand/sült/clay Gravel Gravel Gravel Gravel Cobbles Cobbles/boulders Boulden	Adjacent to structure Distream of structure Upstream of structure Other HANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure CTERISTICS Berm Vegetation None Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees Age Imature	Wind waves Vessel Forces lee rafting Acolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum Willow	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Density None Sparce Medium Diversity Mono-stand Mixed Climax-vegetation Spacing Continuous	Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Health Health Health Health Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Normal Health Health Health Health Health Health Health Unhealthy Dead

REACH 3 - Smaight Peach to Bridge

		SECTION 2 · LEFT	BANK SURVEY		
] PART 8: LEFT BA	NK CHARACTERIS				
Туре	Bank Materials M	lean Bank Height	Layer Thickness	Tension Cracks (Crack Extent
Noncobesive X	Silt/clay	Average height (ft)	Material 1 (ft)	None	Proportion of
Cohesive	Sand/silt/clay	3-6-			
<u> </u>				Occasional	bank height
Composite_	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	
Layered	Sand \	Average angle (o) [30]	Material 4 (ft)		Į.
Even Layers	Sand/gravel 2		-		
Thick+thin layers	Gravel	Distribution	and Description of	Book Massalata to Book	
	• –				
Number of layers	Gravel/cobbles	Material Type 1	Material Type 2	Material Type 3 N	faterial Type 4
	Cobbles	Toe	Toe	Toe	Toe
Protection Status	Cobbles/boulders	Mid-Bnak X	Mid-Bnak X	Mid-Bnak	Mid-Brak
Unprotected X	Boulders/bedrock	Upper Bank	Upper Bank	Upper Bank	Upper Bank
Hard points	\$	Whole Bank	Whole Bank	Whole Bank	Whole Bank
Revelments	ì	D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
Dyke Fields	1	sorting coefficient	· ' -	· · · · · · · · · · · · · · · · · · ·	
Dyxe	J	sorung coemician.	sorting coefficient	sorting coefficient.	sorting coef.
PART 9: LEFT BA	ANK-FACE VEGETA	TION			
Vegetation	Tree Types	Density	Location	Maalah	Walaka
				Health	Height
None_	None	None	Whole bank X	Healthy 🔀	Short
Cleared	Alder	Sparce	Bank top	Fair	Medium X
Grass and flora	Ash	Medium X	Mid-bank	Poor	Tall
					'a"LJ
Reeds and sedges	Beach	Dense	Bank toc	Dead	
Shrubs	Birch		_	_	
Saplings	Cottonwood	Spacing	Diversity	Age	Extent
			· —		
Trees	Elm	Continuous	Mono-stand	Imature	Wide 🔀
	Sweet gum	Close	Mixed X	Mature	Medium
	Willow	Wide	Climan vegetation	Old	Narrow
				٣.	, - Lio Li
L					
D . 000 44 - 5-	Thur. B. 6. 6. 6	anaana			
PART 10: LEFT B	ANK EROSION PRO	CESSES			
Status	Extent	Location	Processes	Distribution of Each	Process on Bank
Intact) Toe □	General	Flow entrainment	Process 1	Process 2
	nueside'				
Eroding X	Dytside Lower bank	Outside Meander X	Piping	Toe []	Toe [
Advancing X	Inside Upper bank	Inside Meander 🗶	Freeze/thaw	Lower bank	Lower bank
-	Whole bank X	Opposite a bar X	Sheet erosion		Upper bank
C 14 -				Upper bank	
Severity	Estimated rate	Behind a ber 🗴	Rilling + gullying	Whole bank	Whole bank
Severity Insignificant					Whole bank
Insignificant	Estimated rate < 3ft/yr	Behind a bar X Opposite a structure	Rilling + gullying Wind waves	Whole bank X Process 3	Whole bank Process 4
Insignificant Mild 💢	Estimated rate < 3ft/yr 3 - 10 ft/yr	Behind a bar X Opposite a structure Adjacent to structure	Rilling + gullying Wind waves Vessel Forces	Whole bank X Process 3 Toe	Whole bank Process 4
Insignificant Mild X Significant	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Behind a bar X Opposite a structure Adjacent to structure Distream of structure	Rilling + gullying Wind waves	Whole bank X Process 3	Whole bank Process 4
Insignificant Mild 💢	Estimated rate < 3ft/yr 3 - 10 ft/yr	Behind a bar X Opposite a structure Adjacent to structure	Rilling + gullying Wind waves Vessel Forces Ice rafting	Whole bank X Process 3 Toe Lower bank	Whole bank Process 4 Toe Lower bank
Insignificant Mild X Significant Serious	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Behind a bar X Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure	Rilling + gullying Wind waves Vessel Forces Ice rafting Aeolian	Whole bank X Process 3 Toe Lower bank Upper bank	Whole bank Process 4 Toe Lower bank Upper bank
Insignificant Mild X Significant	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Behind a bar X Opposite a structure Adjacent to structure Distream of structure	Rilling + gullying Wind waves Vessel Forces Ice rafting	Whole bank X Process 3 Toe Lower bank	Whole bank Process 4 Toe Lower bank
Insignificant Mild X Significant Serious	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Behind a bar X Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure	Rilling + gullying Wind waves Vessel Forces Ice rafting Aeolian	Whole bank X Process 3 Toe Lower bank Upper bank	Whole bank Process 4 Toe Lower bank Upper bank
Insignificant Mild X Significant Serious Catastrophic	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr	Behind a bar X Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other	Rilling + gullying Wind waves Vessel Forces Ice rafting Aeolian	Whole bank X Process 3 Toe Lower bank Upper bank	Whole bank Process 4 Toe Lower bank Upper bank
Insignificant Mild X Significant Serious Catastrophic	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Behind a bar X Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other	Rilling + gullying Wind waves Vessel Forces Ice rafting Aeolian	Whole bank X Process 3 Toe Lower bank Upper bank	Whole bank Process 4 Toe Lower bank Upper bank
Insignificant Mild X Significant Serious Catastrophic	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr	Behind a bar X Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other	Rilling + gullying Wind waves Vessel Forces Ice rafting Aeolian	Whole bank X Process 3 Toe Lower bank Upper bank Whole bank	Whole bank Process 4 Toe Lower bank Upper bank Whole bank
Insignificant Mild X Significant Serious Catastrophic PART 11: LEFT B.	Estimated rate	Behind a bar X Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other HANICS	Rilling + gullying Wind waves Vessel Forces Ice rafting Acolian Other	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each!	Whole bank Process 4 Toe Lower bank Upper bank Whole bank
Insignificant Mild X Significant Serious Catastrophic PART 11: LEFT B.	Estimated rate	Behind a bar X Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other HANICS Location	Rilling + gullying Wind waves Vessel Forces Ice rafting Aeolian Other	Whole bank X Process 3 Toc Lower bank Upper bank Whole bank Whole bank	Whole bank Process 4 Toe Lower bank Upper bank Whole bank Whole bank Mode 2
Insignificant Mild X Significant Serious Catastrophic PART 11: LEFT B. Status Stable X	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr ANK FAILURE MEC Extent INSIDE Toe	Behind a bar X Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Upstream of structure Cher HANICS Location General	Rilling + gullying Wind waves Vessel Forces loe rafting Aeolian Other Fallure Mode Shallow slide	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each ! Mode 1 Toe Toe Toe	Whole bank Process 4 Toe Lower bank Upper bank Whole bank
Insignificant Mild X Significant Serious Catastrophic PART 11: LEFT B. Status Stable X	Estimated rate	Behind a bar X Opposite a structure Adjacent to structure Distream of structure Upstream of structure Upstream of structure Upstream of structure Cher HANICS Location General Outside Meander X	Rilling + gullying Wind waves Vessel Forces Ice rafting Aeolian Other	Whole bank X Process 3 Toc Lower bank Upper bank Whole bank Whole bank	Whole bank Process 4 Toe Lower bank Upper bank Whole bank Whole bank Mode 2
Insignificant Mild X Significant Serious Catastrophic PART 11: LEFT B. Status Stable X Unreliable X	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >ANK FAILURE MEC Extent INSIDÉ TOE DUTJUÉ LOWER bank	Behind a bar X Opposite a structure Adjacent to structure Distream of structure Upstream of structure Upstream of structure Upstream of structure Cher HANICS Location General Outside Meander X	Rilling + gullying Wind waves Vessel Forces Ice rafting Aeolian Other Faiture Mode Shallow slide Rotational slip	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each 1 Mode 1 Toe Lower bank	Whole bank Process 4 Lower bank Upper bank Whole bank Whole bank Toe Lower bank Mode 2 Lower bank Lower bank Lower bank
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Insignificant Mild X. Significant Mild X. Significant Serious Catastrophic PART 11: LEFT B. Status Stable X. Unreliable Y. Unstable Y. Unstable Y. Unstable Severity Insignificant Moderate Serious PART 12: LEFT B. Present Status No berm small berm X. medium berm large berm large berm Berm Location None Only inside bends X. Continuous X. Continuous X. Significant	Estimated rate 3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr > 25 ft/yr > 25 ft/yr ANK FAILURE MEC Extent INSIDÉ Toe DUTSIDÉ Lower bank Whole bank Whole bank Frequency Godh Occasional Frequent ANK BERM CHARA Berm Materials Sill/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Gravel Gravel Gravel Gravel Gravel Gravel Cobbles Cobbles Cobbles	Behind a bar X Opposite a structure Adjacent to structure Upstream of structure Upstream of structure Upstream of structure Other HANICS Location General Outside Meander Apposite a bar X Opposite a bar X Opposite a bar X Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure CTERISTICS Berm Vegetation Rome Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees	Rilling + gullying Wind waves Vessel Forces loe rafting Aeolian Other Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling X Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum	Whole bank	Whole bank Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Health Health Health Health Short Modium Modium Tall
Insignificant Mild X Significant Mild X Significant Serious Catastrophic PART 11: LEFT B. Status Stable X Unreliable X Unreliable X Unreliable X Unstable Serious PART 12: LEFT B. Present Status No berm small berm Mills berm Mills berm A medium berm large berm Berm Location Only inside bends X Continuous Berm Material	Estimated rate < 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent INSIDE Toe DUTSIDE Lower bank Upper bank Whole bank Frequency Goda None Occasional Frequent ANK BERM CHARA Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/Clay Gravel/Cobbles Cobbles/boulders Cobbles/boulders Sand/soulders Cobbles/boulders Sand/soulders Sand/soulders Cobbles/boulders Sand/soulders Cobbles/boulders Sand/soulders Sand/soulders Cobbles/boulders Sand/soulders Cobbles/boulders Sand/soulders Cobbles/boulders Sand/soulders Cobbles/boulders Sand/soulders Cobbles/boulders Sand/soulders Cobbles/boulders Cobbles/cobbles	Behind a bar X Opposite a structure Adjacent to structure Upstream of structure Upstream of structure Upstream of structure Other HANICS Location General Outside Meander X Inside Meander X Opposite a bar X Behind a bar Y Opposite at uncture Adjacent structure Adjacent structure Upstream of structure Upstr	Rilling + gullying Wind waves Vessel Forces Ice rafung Aeolian Other Faiture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling X Berm Tree Types None Alder Ash Birch Cottonwood Emm Beech Sweet gum Willow	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each ! Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Denset Diversity None Sparce Modium Dense Diversity Mono-stand Mixed Climax-vegetation Spacing Continuous Mode Climax-vegetation Spacing Continuous Mixed Climax-vegetation Spacing Continuous Mixed Climax-vegetation Spacing Continuous Mixed Mixed Climax-vegetation Spacing Continuous Mixed Mi	Whole bank Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Upper ba
Insignificant Mild X Significant Serious Catastrophic PART 11: LEFT B. Status Stable X Unreliable Y Unstable Severity Insignificant Moderate Serious PART 12: LEFT B. Present Status No berm small berm A medium berm large berm Berm Location None Only inside bends X Continuous Berm Material Size Data D50 (em)	Estimated rate 3 ft/yr 3 · 10 ft/yr 10 · 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent INSIDÉ Toe DUTSIDÉ Lower bank Upper bank Whole bank Whole bank Frequency Godda None Occasional Frequent ANK BERM CHARA Berm Materials Sil/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Gravel Gravel Gravel Gravel Cobbles/boulders Boulders Boulders Solders Cobbles/boulders Solders Cobbles/boulders Solders Solders Cobbles/boulders Boulders Solders S	Behind a bar X Opposite a structure Adjacent to structure Upstream of structure Upstream of structure Other HANICS Location General Outside Meander X Inside Meander X Inside Meander X Opposite a bar X Behind a bar X Opposite at bar X Opposite at tructure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Charged Grass and flora Reeds and sedges Shrubs Saplings X Trees Age Imature Mature	Rilling + gullying Wind waves Vessel Forces Ice rafung Aeolian Other Faiture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling X Berm Tree Types None Alder Ash Birch Cottonwood Emm Beech Sweet gum Willow	Whole bank Process 3	Whole bank Process 4 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Upper bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper ba
Insignificant Mild X Significant Mild X Significant Serious Catastrophic PART 11: LEFT B. Status Stable X Unreliable Y Unreliable Y Unreliable Y Unstable Y Unstable Y Unstable Serious PART 12: LEFT B Present Status So berm small berm X medium berm large berm large berm Continuous Berm Material Size Data	Estimated rate 3 ft/yr 3 · 10 ft/yr 10 · 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr ANK FAILURE MEC Extent INSIDÉ Toe DUTSIDÉ Lower bank Upper bank Whole bank Whole bank Frequency Godda None Occasional Frequent ANK BERM CHARA Berm Materials Sil/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Gravel Gravel Gravel Gravel Cobbles/boulders Boulders Boulders Solders Cobbles/boulders Solders Cobbles/boulders Solders Solders Cobbles/boulders Boulders Solders S	Behind a bar X Opposite a structure Adjacent to structure Upstream of structure Upstream of structure Upstream of structure Other HANICS Location General Outside Meander X Inside Meander X Opposite a bar X Behind a bar Y Opposite at uncture Adjacent structure Adjacent structure Upstream of structure Upstr	Rilling + gullying Wind waves Vessel Forces Ice rafung Aeolian Other Faiture Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling X Berm Tree Types None Alder Ash Birch Cottonwood Emm Beech Sweet gum Willow	Whole bank Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each ! Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Whole bank Denset Diversity None Sparce Modium Dense Diversity Mono-stand Mixed Climax-vegetation Spacing Continuous Mode Climax-vegetation Spacing Continuous Mixed Climax-vegetation Spacing Continuous Mixed Climax-vegetation Spacing Continuous Mixed Mixed Climax-vegetation Spacing Continuous Mixed Mi	Whole bank Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Health Health Health Health Health Health Health Normal Modium Name of the Short Modium Name

Sub-Reach 1 and 2 - Bend and Straight Read

PART 13: RIGHT	BANK CHARACTER	ISTICS			
Type			Layer Thickness		rack Extent
Noncohesive	Silt/clay 🔀	Average height (ft)		None X	Proportion of
Cohesive X	Sand/silt/clay		Material 2 (ft)	Occasional	bank height
Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	
Layered	Sand	Average angle (o)	Material 4 (ft)		l
Even Layers	Sand/gravel X				
Thick+thin layers X	Gravel X		•	Bank Materials in Bank	
Number of layers 3	Gravel/cobbles 🔀		Material Type 2		laterial Type 4
J	Cobbles	Toe	Toe	Toe	Toe
Protection Status	Cobbles/boulders	Mid-Bnak	Mid-Bnak X	Mid-Bnak	Mid-Bnak
Unprotected	Boulders/bedrock	Upper Bank	Upper Bank	Upper Bank 🗙	Upper Bank
Hard points		Whole Bank	Whole Bank	Whole Bank	Whole Bank
Reverments		D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
Dyke Fields		sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
PART 14: BIGHT	BANK-FACE VEGET	TATION			
Vegetation	Tree Types	Density	Location	Health	Height
None	None N	None -	Whole bank	Healthy 🔀	Short
Cleared	Alder	Sparce	Bank top	Fair	Medium X
Grass and flora X		Medium	Mid-bank	Poor	
Reeds and sedges X	Ash X Beech	Dense X	Bank toe	Dead	Tall [
, <u> </u>	Birch	Deuse X	Dank (OC	Lane	
Shrubs X		S!	Diversion	A	F
Saplings	Cottonwood	Spacing	Diversity	Age	Extent
Trees X	Elm	Continuous	Mono-stand	Imature X	Wide
1	Sweet gum	Close X	Mixed X	Mature	Medium X
	Willow	Wide	Climax-vegetation	OM	Narrow
L					
PART 15: RIGHT	BANK EROSION PR	OCESSES			
Status	Extent	Location	Processes	Distribution of Each	Process on Rank
Intact X	Toe X	General	Flow entrainment	Process 1	Process 2
Eroding	Lower bank	Outside Meander	Piping	Tœ [X]/	Toe□
Advancing	Upper bank	Inside Meander	Freeze/thaw	Lower bank	Lower bank
Advancing	Whole bank	Opposite a bar X	Sheet erosion		
C			——————————————————————————————————————	Upper bank	Upper bank X
Severity	Estimated rate	Behind a bar	Rilling + gullying 2	Whole bank	Whole bank
Insignificant	< 3ft/yr	Opposite a structure	Wind waves	Process 3	Process 4
Insignificant Mild X	< 3ft/yr 3 - 10 ft/yr	Opposite a structure Adjacent to structure	Wind waves Vessel Forces	Process 3	Process 4
Insignificant Mild X Significant	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure	Wind waves Vessel Forces Ice rafting	Process 3 Toe Lower bank	Process 4 Toe Lower bank
Insignificant Mild X Significant Serious	< 3ft/yr 3 - 10 ft/yr	Opposite a structure Adjacent to structure Donstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild X Significant	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Distream of structure	Wind waves Vessel Forces Ice rafting	Process 3 Toe Lower bank	Process 4 Toe Lower bank
Insignificant Mild X Significant Serious	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Donstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild X Significant Serious Catastrophic	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr	Opposite a structure Adjacent to structure Dristream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank	Process 4 Toe Lower bank Upper bank
Insignificant Mild X Significant Serious Catastrophic	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr	Opposite a structure Adjacent to structure Dristream of structure Upstream of structure Other	Wind waves Vessel Forces Ice rafting Aeolian	Process 3 Toe Lower bank Upper bank Whole bank	Process 4 Toe Lower bank Upper bank Whole bank
Insignificant Mild X Significant Serious Catastrophic	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >BANK FAILURE ME	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS	Wind waves Vessel Forces Ice rafting Aeolian Other	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each	Process 4 Toe Lower bank Upper bank Whole bank Whole bank
Insignificant Mild X Significant Serious Catastrophic	< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr BANK FAILURE ME Extent	Opposite a structure Adjacent to structure Dustream of structure Upstream of structure Other CHANICS Location	Wind waves Vessel Forces Ice rafting Aeolisn Other Fallure Mode	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1	Process 4 Toe Lower bank Upper bank Whole bank Adde on Bank Mode 2
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable	< 3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr BANK FAILURE ME Extent Toe	Opposite a structure Adjacent to structure Dristream of structure Upstream of structure Other CHANICS Location General	Wind waves Vessel Forces Ice rafting Aeolian Other Failure Mode Shallow slide 7	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe	Process 4 Toe Lower bank Upper bank Whole bank Adde on Bank Mode 2 Toe Toe
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr >25 ft/yr BANK FAILURE ME Extent Toe Lower bank	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander	Wind waves Vessel Forces Ice rafung Acolian Other Fallure Mode Shallow slide [1] Rotational slip	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank	Process 4 Toe Lower bank Upper bank Whole bank Whole bank Mode 2 Toe Lower bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr Extent Toe Lower bank Upper bank X	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Cthanics Location General Outside Meander Inside Meander	Wind waves Vessel Forces Ice rafung Aeolian Other Fallure Mode Shallow slide 7 Rotational slip Slab-type 2	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank	Process 4 Toe Lower bank Upper bank Whole bank Ande on Bank Mode 2 Toe Lower bank Upper bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable	<pre>< 3ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >BANK FAILURE ME Extent Too Lower bank Upper bank Whole bank</pre>	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide 1 Rotational slip Slab-type 2 Pop-out failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank	Process 4 Toe Lower bank Upper bank Whole bank Ande on Bank Mode 2 Toe Lower bank Upper bank Whole bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT Status Stable Unreliable Unstable Severity	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Inside Meander Opposite a bar Behind a bar	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide 1 Rotational slip Slab-type 2 Pop-out failure Cantilever failure 3	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each N Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Mode 3	Ande on Bank Mode 2 Toe Lower bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable I Insignificant I Insignificant	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Opposite structure	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide [1 Rotational slip Slab-type 2 Pop-out failure 3 Piping	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Toc Toc	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Mode 4 Toe
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable Insignificant Moderate X	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr >25 ft/yr Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional X	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide 7 Rotational slip Slab-type 2 Pop-out failure Cantilever failure 3 Piping Flow failure	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Toc Lower bank Node 3 Toc Lower bank	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Toe Lower bank Mode 4 Toe Lower bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable I Insignificant I Insignificant	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide [1 Rotational slip Slab-type 2 Pop-out failure 3 Piping	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable Insignificant Moderate X	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr >25 ft/yr Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional X	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide 7 Rotational slip Slab-type 2 Pop-out failure Cantilever failure 3 Piping Flow failure	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Toc Lower bank Node 3 Toc Lower bank	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Toe Lower bank Mode 4 Toe Lower bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable Insignificant Moderate X	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr >25 ft/yr Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional X	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide 7 Rotational slip Slab-type 2 Pop-out failure Cantilever failure 3 Piping Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable Severity Insignificant Moderate X Serious	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr >25 ft/yr Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional X	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide 7 Rotational slip Slab-type 2 Pop-out failure Cantilever failure 3 Piping Flow failure	Process 3 Toe Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Toe Lower bank Upper bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable Severity Insignificant Moderate X Serious	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank X Whole bank Frequency None Occasional X Frequent	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide 7 Rotational slip Slab-type 2 Pop-out failure Cantilever failure 3 Piping Flow failure Ravelling	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Whole bank Mode 3 Toc Lower bank Whole bank Whole bank	Toe Lower bank Upper bank Whole bank Upper bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Whole bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Upper bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure ACTERISTICS Berm Vegetation	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide I Rotational slip Slab-type 2 Pop-out failure Cantilever failure Ravelling Berm Tree Types	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each N Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Upper bank Upper bank Upper bank	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Whole bank Upper bank Health
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Insignificant Moderate Serious PART 17: RIGHT	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure ACTERISTICS Berm Vegetation None	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide 7 Rotational slip Slab-type 2 Pop-out failure Cantilever failure 3 Piping Flow failure Ravelling	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Health Health
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unreliable Unreliable X Unstable Insignificant Moderate Serious PART 17: RIGHT Present Status No berm X small berm	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Cleared Cleared	Wind waves Vessel Forces Ice rafung Acolian Other Fallure Mode Shallow slide [] Rotational slip Slab-type 2 Pop-out failure Cantilever failure Cantilever failure Ravelling Berm Tree Types None Alder	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Upper bank Verbank Verban	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Health Health Health Unhealthy Unhealthy
Insignificant Midd X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unreliable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm Status I Statu	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank X Whole bank Frequency None Occasional X Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure Cheared Grass and flora	Wind waves Vessel Forces lee rafting Acolian Other Fallure Mode Shallow slide 7 Rotational slip Slab-type 2 Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Addr Addr	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Density None Sparce Medium	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Health Health
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable I Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm semal berm medium berm large berm	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 10 - 25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Upper bank Verequency None Occasional Frequent Sit/clay Sand/sit/clay Sand/sit/clay Sand/sit/sand	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure ACTERISTICS Berm Vegetation None Ceared Grass and floor Reeds and sedges	Wind waves Vessel Forces lee rafting Acolian Other Fallure Mode Shallow slide [1] Rotational slip Slab-type 2 Pop-out failure Cantilever failure Cantilever failure Ravelling Berm Tree Types None Alder Ash Birch	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Whole bank Mode 3 Toc Lower bank Upper bank Whole bank Dense Sparce Modium Dense	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Health Health Health Unhealthy Unhealthy Dead
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unreliable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm medium berm large berm Berm Location	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Salt/clay Sand/sit/clay Sand/sit/clay Sand/sit/sy	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a barr Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure Cleared Grass and flora Reeds and sedges Shrubs	Wind waves Vessel Forces Ice rafung Acolian Other Fallure Mode Shallow slide [1] Rotational slip Slab-type 2 Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Upper bank	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Hode 4 Toe Lower bank Upper bank Whole bank Upper bank Health
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unreliable Unreliable Serious Serious PART 17: RIGHT Present Serious PART 17: RIGHT Present Serious No berm Sumall berm medium berm large berm Berm Location None	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay Sand/silt/sand Sand/gravel Gravel	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure Cleared Grass and flora Reeds and sedges Shrubs Saplings	Wind waves Vessel Forces Ice rafting Acolian Other Fallure Mode Shallow slide [] Rotational slip Slab-type 2 Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Em	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Density None Sparce Modum Dense Diversity Mono-stand	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Health Health Health Health Unhealthy Unhealthy Dead Height Short
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unreliable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm semall berm medium berm large berm Berm Location None Only inside bends	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 25 ft/yr >25 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional X Frequent BANK BERM CHAR Berm Materials Sitt/clay Sand/sitt/clay Sand/sitt/clay Gravel Gravel Gravel Gravel Gravel Gravel/cobbles	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a barr Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure Cleared Grass and flora Reeds and sedges Shrubs	Wind waves Vessel Forces lee rafung Acolian Other Fallure Mode Shallow slide 1 Rotational slip Slab-type 2 Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each N Mode 1 Toc Lower bank Upper bank Whole bank Mode 3 Toc Lower bank Whole bank Whole bank Density None Sparce Medium Densit Diversity Mono-stand Mixed	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Whole bank Mode 4 Toe Lower bank Upper bank Health Upper bank Whole bank Health Health Health Health Upper bank Whole bank
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable X Unstable I Unstable I Severity Insignificant Moderate X Serious PART 17: RIGHT Present Status No berm small berm medium berm large berm Berm Location None Only inside bends Continuous	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional X Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay Sand/silt/clay Sand/silt/clay Carvel Gravel/cobbles Cobbles	Opposite a structure Adjacent to structure Distream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure Chanical Structure Adjacent structure Onstream of structure Onstream of structure Creamed Grass and floor Reeds and sedges Shrubs Saplings Trees	Wind waves Vessel Forces lee rafting Acolian Other Fallure Mode Shallow slide [1] Rotational slip Slab-type [2] Pop-out failure Cantilever failure [3] Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each N Mode 1 Toc Lower bank Upper bank X Whole bank Mode 3 Toc Lower bank Upper bank X Whole bank Mode 3 Toc Lower bank Upper bank X Whole bank Upper bank Upper bank Climas vegetation Climas vegetation	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Whole bank Mode 4 Toe Lower bank Whole bank Health
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unreliable Unstable Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm medium berm large berm Berm Location None Only inside bends Continuous Berm Material	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sit/clay Sand/sit/clay Sond/sit/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees	Wind waves Vessel Forces lee rafting Acolian Other Fallure Mode Shallow slide [1] Rotational slip Slab-type 2 Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum Willow	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Upper bank Whole bank Density None Sparce Medium Dense Diversity Mono-stand Mixed Climax-vegetation Spacing	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unreliable Unreliable I Unstable Unstable I Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm X small berm medium berm large berm Berm Location None Only inside bends Continuous Berm Material Size Data	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sand/sitt/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Upstream of structure Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees Age Imature	Wind waves Vessel Forces lee rafting Acolian Other Fallure Mode Shallow slide [1] Rotational slip Slab-type [2] Pop-out failure Cantilever failure [3] Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Clower bank Upper b	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Health Health Health Health Upper bank Whole bank Toe Lower bank Upper
Insignificant Mild X Significant Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unreliable Unstable Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm medium berm large berm Berm Location None Only inside bends Continuous Berm Material	3 ft/yr 3 - 10 ft/yr 10 - 25 ft/yr 225 ft/yr >25 ft/yr >25 ft/yr SANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent Sit/clay Sand/sit/clay Sond/sit/clay	Opposite a structure Adjacent to structure Dnstream of structure Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure Upstream of structure Cleared Grass and flora Reeds and sedges Shrubs Saplings Trees	Wind waves Vessel Forces lee rafting Acolian Other Fallure Mode Shallow slide [1] Rotational slip Slab-type 2 Pop-out failure Cantilever failure Ravelling Flow failure Ravelling Berm Tree Types None Alder Ash Birch Cottonwood Elm Beech Sweet gum Willow	Process 3 Toc Lower bank Upper bank Whole bank Distribution of Each Mode 1 Toc Lower bank Upper bank Whole bank Whole bank Whole bank Whole bank Upper bank Whole bank Upper bank Whole bank Density None Sparce Medium Dense Diversity Mono-stand Mixed Climax-vegetation Spacing	Process 4 Toe Lower bank Upper bank Whole bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper

Reach 2 - 2nd Bend

			BANK SURVEY		
PART 13: RIGHT	BANK CHARACTER				
Type	Bank Materials Me	ean Bank Height]	ayer Thickness	Tension Cracks	Crack Extent
Noncohesive	Silt/clay	Average height (ft) 5	Material 1 (ft)	None	Proportion of
Cohesive	Sand/silt/clay		Material 2 (ft)	Occasional	bank height
Composite	Sand/silt	Mean Bank Slope	Material 3 (ft)	Frequent	
	. —			1100	
Layered	Sand	Average angle (0) 60	Material 4 (ft)		
Even Layers	Sand/gravel				
Thick+thin layers	Gravel	Distribution	and Description of	Bank Materials in Bas	k Profile
Number of layers	Gravel/cobbles	Material Type 1	Material Type 2	Material Type 3	Material Type 4
	Cobbles	Toe	Toe	Toe	Toe
Barra alla Cara			Mid-Bnak		
Protection Status	Cobbles/boulders	Mid-Bnak		Mid-Bnak	Mid-Bnak
Unprotected X	Boulders/bedrock	Upper Bank	Upper Bank	Upper Bank	Upper Bank
Hard points		Whole Bank	Whole Bank	Whole Bank	Whole Bank
Revetments		D50 (mm)	D50 (mm)	D50 (mm)	D50 (mm)
Dyke Fields		sorting coefficient	sorting coefficient	sorting coefficient	sorting coef.
Dyne (*2200 [sorming cocanicion	Lorang Courterent	soming coefficient	solding coel.
PART 14: RIGHT	BANK-FACE VEGET	ATION			
Vegetation	Tree Types	Density	Location	Health	Height
None	None	None	Whole bank	Healthy	Short
Cleared	Alder			Fair	
		Sparce	Bank top		Medium
Grass and flora	Ash X	Medium	Mid-bank	Poor	Tall
Reeds and sedges X	Beech	Dense 💢	Bank toe	Dead	
Shrubs X	Birch	_	-	_	
Saplings X	Cottonwood X	Spacing	Diversity	Age	Extent
Trees	Elm	Continuous	Mono-stand	Imature X	Wide 🔀
į.	Sweet gum	Close	Mixed	Mature ×	Medium
i	Willow X	Wide	Climax-vegetation	Old	Narrow
į.	Sycamore 😿			-	_
					
BART IS BICUT I	BANK EROSION PRO	VCECCEC			
1			_		
Status_	Extent_	Location	Processes	Distribution of Each	
Intact X	Toe []	General	Flow entrainment	Process 1_	Process 2
Eroding	Lower bank	Outside Meander	Piping	Toe 🗀	Toe \square
Advancing	Upper bank	Inside Meander	FreezeAhaw	Lower bank	Lower bank
/ Advancing					
ł _	Whole bank	Opposite a bar	Sheet erosion	Upper bank	Upper bank
Severity	Estimated rate	Behind a bar	Rilling + gullying	Whole bank	Whole bank
Insignificant	< 3ft/yr	Opposite a structure	Wind waves	Process 3	Process 4
Mild	3 - 10 ft/yr	Adjacent to structure	Vessel Forces	Toe 🗍	Toe 🗍
l Cinnifian-il I	10 25 64	~ · · · · · · · · · · · · · · · · · · ·	Inn refring	1 awaa baak	
Significant	10 - 25 ft/yr	Distream of structure	Ice rafting	Lower bank	Lower bank
Serious	10 · 25 ft/yr	Upstream of structure	Aeolian	Upper bank	Upper bank
					
Serious		Upstream of structure	Aeolian	Upper bank	Upper bank
Serious		Upstream of structure	Aeolian	Upper bank	Upper bank
Serious Catastrophic	>25 ft/yr	Upstream of structure Other	Aeolian	Upper bank	Upper bank
Serious Catastrophic		Upstream of structure Other	Aeolian	Upper bank Whole bank	Upper bank Whole bank
Serious Catastrophic PART 16: RIGHT I	>25 fuyr□	Upstream of structure Other	Aeolian Other	Upper bank Whole bank Distribution of Each	Upper bank Whole bank Mode on Bank
Serious Catastrophic PART 16: RIGHT I	>25 ft/yr BANK FAILURE ME Extent	Upstream of structure Other	Aeolian Other	Upper bank Whole bank Distribution of Each Mode 1	Upper bank Whole bank Mode on Bank Mode 2
Serious Catastrophic PART 16: RIGHT I	>25 fuyr□	Upstream of structure Other	Aeolian Other	Upper bank Whole bank Distribution of Each	Upper bank Whole bank Mode on Bank
Serious Catastrophic PART 16: RIGHT I	>25 ft/yr BANK FAILURE ME Extent Toe	Upstream of structure Other	Aeolian Other	Upper bank Whole bank Distribution of Each Mode 1 Toe	Upper bank Whole bank Mode on Bank Mode 2 Toe
PART 16: RIGHT I Status Stable Unreliable	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank	Upstream of structure Other CHANICS Location General Outside Meander	Failure Mode Shallow slide Rotational slip	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank	Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank
Serious Catastrophic PART 16: RIGHT I	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander	Failure Mode Shallow slide Rotational slip Slab-type	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank	Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank
PART 16: RIGHT I Status Stable Unreliable Unstable	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank	CHANICS Location General Outside Meander Inside Meander Opposite a bar	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank	Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank
PART 16: RIGHT I Status Stable Unreliable	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander	Failure Mode Shallow slide Rotational slip Slab-type	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank	Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank
PART 16: RIGHT I Status Stable Unreliable Unstable	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank	CHANICS Location General Outside Meander Inside Meander Opposite a bar	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank	Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank
PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency	Upstream of structure Other Location General Outside Meander Inside Meander Opposite a bar Behind a bar X Opposite structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe	Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe
PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional	CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Ande 3 Toe Lower bank	Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank
PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank Upper bank	Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank
PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Whole bank Ande 3 Toe Lower bank	Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank
PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Dnstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank Upper bank	Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank
PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate Serious	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank Upper bank	Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank
PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Upper bank Upper bank	Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank
PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Upstream of structure Upstream of structure ACTERISTICS	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank	Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Whole bank
Serious Catastrophic PART 16: RIGHT I Status Stable V Unreliable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar A Opposite structure Adjacent structure Upstream of structure Upstream of structure ACTERISTICS Berm Vegetation	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Plow failure Ravelling Revelling	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Whole bank Whole bank	Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Upper bank Health
Serious Catastrophic PART 16: RIGHT I Status Stable V Unreliable Unstable SeverIty Insignificant Moderate Serious PART 17: RIGHT Present Status No berm	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay	Upstream of structure Other Location General Outside Meander Inside Meander Opposite a bar Behind a bar A Opposite structure Adjacent structure Upstream of structure Upstream of structure ACTERISTICS Berm Vegetation None	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Whole bank Whole bank	Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Health
Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm Small berm	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure ACTERISTICS Berm Vegetation None Cleared	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder	Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Sparce	Whole bank Mode on Bank Mode 2 Toc Lower bank Upper bank Whole bank Mode 4 Toc Lower bank Upper bank Whole bank Health Health Health Unhealthy
Serious Catastrophic PART 16: RIGHT I Status Stable V Unreliable Unstable SeverIty Insignificant Moderate Serious PART 17: RIGHT Present Status No berm	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay	Upstream of structure Other Location General Outside Meander Inside Meander Opposite a bar Behind a bar A Opposite structure Adjacent structure Upstream of structure Upstream of structure ACTERISTICS Berm Vegetation None	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Whole bank Whole bank	Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Mode 4 Toe Lower bank Upper bank Upper bank Upper bank Upper bank Health
PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm medium berm	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay	Upstream of structure Other CHANICS Location General Outside Meander Inside Meander Opposite a bar Behind a bar Opposite structure Adjacent structure Distream of structure Upstream of structure ACTERISTICS Berm Vegetation None Cleared	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Cantilever failure Piping Flow failure Ravelling Berm Tree Types None Alder	Upper bank Whole bank Distribution of Each Mode I Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Whole bank Upper bank Upper bank Upper bank Upper bank Upper bank Upper bank Sparce	Whole bank Mode on Bank Mode 2 Toc Lower bank Upper bank Whole bank Mode 4 Toc Lower bank Upper bank Whole bank Health Health Health Unhealthy
Serious Catastrophic PART 16: RIGHT I Status Stable Unreliable Unstable Severity Insignificant Moderate Serious PART 17: RIGHT Present Status No berm small berm large berm large berm	>25 ft/yr BANK FAILURE ME Extent Toe Lower bank Upper bank Whole bank Frequency None Occasional Frequent BANK BERM CHAR Berm Materials Silt/clay Sand/silt/clay Sand/silt/sand	Upstream of structure Other Location General Outside Meander Inside Meander Opposite a bar Behind a bar Acpposite structure Adjacent structure Upstream of structure Upstream of structure ACTERISTICS Berm Vegetation None Cleared Grass and floora Reeds and sedges	Failure Mode Shallow slide Rotational slip Slab-type Pop-out failure Piping Flow failure Ravelling Rerm Tree Types Nome Alder Ash Birch	Upper bank Whole bank Distribution of Each Mode 1 Toe Lower bank Upper bank Whole bank Mode 3 Toe Lower bank Upper bank Upper bank Whole bank Whole bank Whole bank Whole bank	Upper bank Whole bank Mode on Bank Mode 2 Toe Lower bank Upper bank Whole bank Upper bank
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APPENDIX D Comments from Corps' Engineers on Sheets and Guidelines

1. FIELD DATA COLLECTION AND EQUIPMENT

- Add Dictaphone for making field notes.
- surveying, use a transit for more accurate work.
- Supply a disposable camera for field photographs.
- Maintain groups of 3 people for work.
- Replace hammer/hatchet with a machete.
- Use a Brunton Compass instead of separate compass and inclinometer.
- Add a set of webbing for holding equipment.
- Add a canteen.
- Add an umbrella.
- Add a hip chain.
- Supply a longer leveling rod. 25ft in place of 14ft.
- Include a sediment sizer and centimeter scale.

2. SEDIMENT ASSESSMENT SHEETS AND GUIDELINES

- Add place for notes from local people.
- Add a place for field sketches.
- Mark on sheets + maps places for adding likely spots for HEC-6 x-sections.
- No need to differentiate bank erosion processes from failure mechanisms.
- Locate features on maps and aerial photographs.
- In Part 5, add a place for recording presence of clay plugs.
- Make sheets laminated in plastic and use a grease pencil to fill them in.
- Add overbank values for Manning's "n" coefficients.
- Use photographs to illustrate user manual, like Ven Te Chow's book.
- Explain what is meant by a large berm.
- Put in places to take photographs.
- Add section on debris in channel and on flood plain.
- Armoring section, add size of largest particle moved.
- Add Appendix on sediment properties and Wentworth Scale.
- Turn the sheets into computer input sheets for data storage and retrieval.

3. INTERPRETATION OF SEDIMENT ASSESSMENT SHEET INFORMATION.

A. Groups 1.2 and 3.

- Stream is graded with respect to aggradation and degradation. It has degraded in the past, but is no longer doing so. In fact it shows some evidence of aggradation in terms of bed, bar and overbank sedimentation.
- Stream width is generally stable, but with some narrowing at specific locations. Point bars in bends appear to be growing and advancing into channel and above bridges narrowing is evident. Generally, though width is adjusted.
- The bed of the channel is stable through the study reach with no clear scouring or filling.
- The channel is moving laterally as expected for a sinuous stream. The right bank is stable but the left bank shows places of instability and failure at the outside of bends. Migration is mostly towards the left bank therefore.
- Problems related to sediment impacts are not serious. Both bridges appear to be in no danger of failure due to scouring, filling or bank erosion. Houses built in the flood plain on the left bank are sufficiently far back from the channel. It is concluded that no economic justification for engineering action exists at present. However, the level of sedimentary activity warrants continued monitoring of the reach.
- One possible cause of future problems concerns an abandoned channel on the right side of the present stream course. This is deeply incised and not very secure. As the channel cuts across the inside of a large bend, it has the potential to capture the flow through a channel avulsion. This would occur if overbank flow in the presently abandoned channel head-cut sufficiently to capture the flow during flood recession. Worst case scenario is a re-creation of an old channel alignment putting the lower (Tiftontown) bridge in jeopardy. At present the flood plain and abandoned channel are heavily vegetated with trees, giving a very high friction factor and ensuring slow overbank flow velocities. These tress should be left to serve this purpose. If they were to be removed, a grade control structure and riprap should be installed to prevent possible head cutting and channel avulsion.

B. Groups 3.4 and 5.

- Channel is degradational, recovering to close to graded. Some bed armoring is apparent, indicating past degradational tendencies in the channel.
 - Width is fairly stable, but with some narrowing through berm building.

- Bars are not extensive or dominant. They are moving through cutting and filling.
 - Banks are cutting at the outside of bends and filling at the inside of bends.
- Some local engineering protection of the banks may be called for at the outer bank in the active meander bend, in sub-reach 2.
- A short analysis of planform changes historically helps explain trends in channel sediment related problems. In 1956 the sinuosity of the channel was approximately 1.7, according to the aerial photographs supplied. In the early 1960's the channel was straightened upstream of Tiftontown bridge, reducing the sinuosity to 1.4. Since then bed scouring and accelerated bank erosion at the outside of bendways has occurred, leading to a recovery of sinuosity to about 1.65. As this is close to the original value, it may be concluded that a reduction in lateral activity should be expected. A regime analysis should be performed to determine what the regime geometry of this ch. nnel is and see where the present channel sets in relation to the regime condition.